DOCUMENT RESUME

ED 306 121 SE 050 526

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TITLE Living with Insects in the Big City. Urban Insect Ecology and Safe Pest Management. A Science Curriculum for Grades K-3.
INSTITUTION Latino Commission of Tri-State, New York, NY.
PUB DATE 87
NOTE 74p.; Some drawings may not reproduce well.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Biology; Ecology; Economic Factors; *Elementary School Science; *Entomology; *Health Education; Insecticides; Pesticides; *Pests; Primary Education; Safety Education; *Science Activities; Science Curriculum; Science Instruction; Teaching Methods; *Urban Areas; Urban Environment; Urban Problems

ABSTRACT

This program has 10 units, each to be taught in 40-50 minute periods. Each unit includes a statement of purpose, concepts to be taught, a list of necessary materials, preparation, and graphics. Guidelines are provided for 10-15 minutes of introduction with classroom discussion, 15-20 minutes of activities and 5-10 minutes of wrap-up discussion. Recommendations for follow up activities are also included. A general introduction to insects can be found at the beginning of the curriculum. Detailed information on non-toxic pest control for some common pests has been included in the appendices. The five general insect graphics provided can be used throughout the project as visual aids and some suggestions for use have been included in specific units. Topics include: urban insects; live insects; chain of life; pesticides; media and insects; biting insects; kitchen insects; and pest management. Although the units have been developed to follow a sequence of concepts dealing primarily with non-toxic pest control, they can also be used separately as parts of any environmental or natural science curriculum. (MVL)

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LIVING WITH INSECTS IN THE BIG CITY

URBAN INSECT ECOLOGY AND SAFE PEST MANAGEMENT

A Science Curriculum for
Grades K - 3

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Citizens for a Better Environment
San Francisco, California

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Citizens for a Better Environment is a non-profit environmental watchdog group which works to protect public health from exposure to toxics in the urban environment.

ACKNOWLEDGEMENTS

Helpful ideas and background information for this curriculum were provided by the Bio-Integral Resource Center, Berkeley CA; Gina Purin of the Golden Empire Health Planing Center, Sacramento, CA; and Kathleen Letcher Cowles, formerly of the John Muir Institute, Morgantown, West Virginia.

Caterpillar, ant, mantid, and lady beetle graphics were used with permission from the Entomological Society of America, College Park, Maryland.

Principal Barbara Penny-James, teacher Louise Rosenkrantz and other teachers at Le Conte School, Berkeley, CA gave helpful input and assisted in piloting the curriculum.

Cover graphics and other student drawings were provided by K - 3rd grade students at Le Conte School, Berkeley, CA.

Some of the slide originals for the Unit 1 slide show on urban insects were provided courtesy of E. S. Ross, California Academy of Sciences.

Primary funding came from generous donations by Citizens for a Better Environment's nearly 17,000 San Franciso Bay Area members. Additional funding was provided by the Friendship Fund.

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Introduction

Approximately 100 million pounds of pesticides are applied in urban areas of California each year, according to Department of Food and Agriculture reports. Public agencies, including school districts, make up one significant group of urban pesticide users. Many schools continue to use hazardous pesticides to control insect and weed pest problems on school grounds and in classrooms and cafeterias.

Pesticides are poisons, made to interfere with biological systems, and as such pose an inherent threat to people and especially to children who may be exposed to them. Yet pesticides are often used as a first-choice option in pest control. Non-toxic pest control methods receive scant attention. Pesticide use in schools is often routine, without monitoring to see if a need for pest control continues to exist. Schools are unnecessarily exposing children to these hazardous chemicals.

For example, the Berkeley School District in 1984 was regularly using lindane for ant control. Lindane is a persistent agricultural pesticide shown in laboratory tests to be carcinogenic. It can also cause nerve and blood disorders. The district was also using diazinon and propetamphos (Safrotin) for monthly indoor insect control.

In Santa Clara County chlordane was sprayed for ants in an Alum Rock School District classroom in 1983. A teacher and teacher's aid reported headaches and itching eyes and throats from exposure to the insecticide. Chlordane is a chlorinated hydrocarbon banned for most use due to its cancer-causing ability and other hazards. The school district subsequently washed the room several times with a "disinfectant cleaner," used an air freshener and eventually repainted the classroom.

The use of insecticidal shampoos to control head lice is a school district problem of particular concern because one frequently used shampoo contains lindane. According to the U.S. Environmental Protection Agency's (EPA's) Scientific Advisory Panel, lindane is easily absorbed through the skin, and "is substantially more toxic to young (humans) than adults..." The curriculum contains a unit on head lice biology and safe control.

Schools should serve as examples to the rest of the community, teaching people to control pest problems in the safest way possible. The best way to ensure safe, consistent pest control in our schools and other public buildings is to create community-wide policies that outline how pest problems will be dealt with. In October 1984, the Berkeley School Board adopted a comprehensive pest management policy developed by the City of Berkeley. This policy commits the school district to minimizing and/or eliminating the use of pesticides in the schools while providing effective pest management through safer, non-chemical methods.

This curriculum has been developed with three major goals in mind:

1) To help school districts such as Berkeley implement a safe pest management policy by teaching students and teachers how they contribute to school pest problems and what they can do to help;

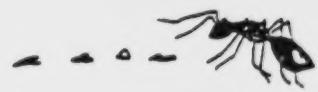
2) To help effectively manage pests and cut down on pesticide use in the home, where most pesticide illnesses are caused. Children will carry what they learn home to their parents; and

3) To begin teaching children not to fear and hate insects. Much home insecticide use could be eliminated if people better understood the important role insects play in the ecosystem, and if they learned to distinguish between benign and bothersome insects.

By using this curriculum, students and teachers will learn: 1) how they contribute to pest problems at school; 2) how they can help to safely control pests, which are often similar to those in their homes; 3) why it is important to avoid over-use of potentially hazardous pesticides by adopting safer pest management practices; and 4) that many organisms which we perceive as "pests" are actually useful or interesting creatures.

This Urban Insect Ecology and Safe Pest Management Curriculum has been developed to address a crying need for education in our classrooms on the dangers of careless pesticide use and about safe pest control. Teachers and students must learn how to understand and safely control pest problems both at school and in their own homes.

What is Integrated Pest Management (IPM)?



This curriculum will introduce students and teachers to the basic concepts of Integrated Pest Management (IPM). IPM is a decision-making process designed to achieve the safest, most effective control of the pest, based on a knowledge of that pest's ecology. IPM may employ many pest control techniques including biological, cultural, mechanical and chemical methods. Some of the basic IPM concepts are:

1. KNOW YOUR PEST. To be most effective, pest control methods must be specific to the particular pest. An organism lives in a certain place because it has everything it needs to live there. Understanding what those things are is essential to finding a way to control that organism. Equally important is an understanding of when a particular organism has actually become a problem. An ant crawling along the sidewalk is not a problem. Ants crawling in and out of lunch boxes are.

2. CHANGE THE PEST'S HABITAT. Once you understand why your pest is successful living where it is, you can remove the things it needs and disrupt its living processes. What does the pest eat or drink? Where does it live, during each of its life stages? Where and how does it breed? If you can eliminate one or more of its life needs, you have probably solved the pest problem.

3. ENCOURAGE NATURAL ENEMIES OF THE PEST. Better known as "biological control," this method requires an understanding of the pest's interaction with other organisms. Predators, parasites, and even disease organisms specific to that pest can be introduced into the habitat. These natural enemies often already occur locally, and can be manipulated to enhance their effectiveness.

4. USE CAREFUL AND SELECTIVE CHEMICAL CONTROLS ONLY WHEN ABSOLUTELY NECESSARY. Chemicals intended to kill pests can also kill natural enemies or other beneficial organisms, as well as posing a health threat to people. Pests can also build up resistance to chemicals. To be most effective, the correct chemical must be applied carefully, and in the proper time and place.

5. EDUCATE YOURSELF ABOUT THE ORGANISMS YOU LIVE WITH. To avoid providing food and shelter to insects or other organisms that we don't want around requires a thorough understanding of the biology of those organisms. Many plants and animals thought of as pests are actually essential to maintaining a balance in the ecosystem as a whole.

How to Use This Curriculum

This program is intended for primary-aged students (K-3rd grade). It has ten units, each to be taught in 40-50 minute periods. Each unit includes a statement of purpose, concepts to be taught, a list of necessary materials, preparation, and graphics. Guidelines are provided for 10-15 minutes of introduction with classroom discussion, 15-20 minutes of activities and 5-10 minutes of wrap-up discussion. Recommendations for follow-up activities are also included.

A general introduction to insects can be found at the beginning of the curriculum. Detailed information on non-toxic pest control for some common pests has been included in the appendices. The five general insect graphics provided can be used throughout the project as visual aids; some suggestions for use have been included in specific units. Graphics that are used for class activities should be colored (optional) and covered with laminating plastic for durability.

Although the units have been developed to follow a sequence of concepts dealing primarily with non-toxic pest control, they can also be used separately as parts of any environmental or natural science curriculum (see page 4).

Teaching Concepts from the California Science Framework Addendum

This curriculum can be used to help teach most of the animal and ecosystem concepts recommended for primary students in the California State Department of Education Science Framework Addendum.

The following animal biology concepts are introduced in Unit 1 and 2 and carried throughout the curriculum, focused on insects.

***Animals have characteristics by which they can be described and identified. Animals can be classified according to various characteristics; e.g. size, body structure, where they live, what they eat, and so forth.**

***There is great diversity among animals.**

***Animals move in different ways.**

***All animals need food, water, and air and a place to live.** (Emphasized in Unit 4 and in pest control for Units 7-10).

***Animals reproduce their own kind.**

***In some animals, including human beings and most other mammals, the young grow within the mother's body before they are born. In most other animals, the young develop from eggs laid by the mother.** (Units 7 and 8 provide a chance to emphasize the fact that insects come from eggs and go through a very definite life style).

The following ecosystem biology concepts are also introduced in the first two units, and then emphasized in the specific units noted.

***Each organism needs special kinds of food and a special place to live.** (Emphasized in pest control in Units 7-10)

The following three concepts, which develop the ecosystem concept, are most emphasized in Unit 3.

***Living organisms obtain the resources they need from each other and from the environment.**

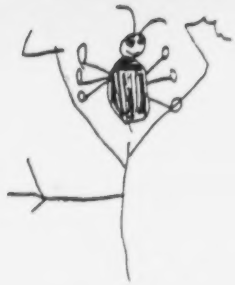
***Animals eat plants and/or other animals.**

***Usually, several kinds of living organisms live with or near each other.**

***Living organisms change from day to day, season to season, year to year.** (This concept is most developed in Units 7 and 8 where students learn about the concept of life cycles in insects.)

One specific concept from human biology is taught.

***People get sick or die when they inhale or swallow poisons.** (Unit 5)



Summary of Program Units

Unit 1. INTRODUCTION TO URBAN INSECTS

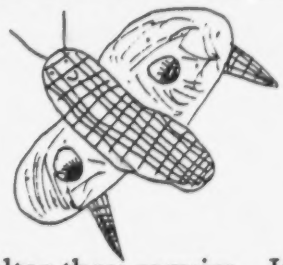
Students learn what an insect is and how they differ from spiders and other small animals in their environment. A slide show on urban insects introduces them to both "helpful" and "bothersome" insects. Students then go outside to discover and observe insects in their school yard.

Unit 2. LIVE INSECTS IN THE CLASSROOM

Several kinds of live insects are brought into the classroom (in escape-proof containers). Students learn first hand that insects are fascinating live animals. Students can look closely at each insect's parts. They watch the insect eat and move, and begin to learn about the different life stages of insects.

Unit 3. INSECTS IN THE "CHAIN OF LIFE"

Using story-telling, students are introduced to the concept of the "chain of life," or how all organisms in our environment are connected to and dependent on each other. Insects are an integral link in that chain. Students use their imaginations to become one link in a chain of life story told by the entire class, and then to draw a picture and fit it into a pictorial chain of life.



Unit 4. CITY INSECTS

Insects cannot survive in the city without the food and shelter they require. If we want insects to share and decorate our urban environment, we must make sure their needs are met. By counting how many insects are found in a paved area near school as compared to a weedy/planted area, students have the chance to observe for themselves which kind of environment supports more insects. Students then draw insects they would like to have around and superimpose them on our urban landscape to see how beautiful a city with insects can be.

Unit 5. INSECTS AND THE MEDIA

The media often portray insects as monstrous and horrible creatures. Students learn to distinguish between "real" and "pretend" (cartoon) portrayals of insects. By creating their own insect comic strips, they learn how cartoons can be manipulated to make insects appear "mean" or "friendly."

Unit 6. PESTICIDES ARE POISONS

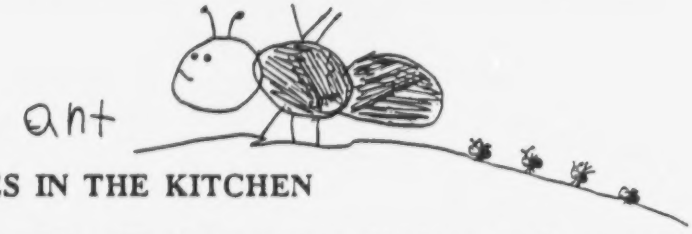
Many pesticides made to kill insects are poisons that may also harm people. Students practice distinguishing between safe and poisonous household products (including pesticides) and learn where dangerous products should be stored safely. Students learn to recognize product warning statements and symbols which they use to create their own safety labels.

Unit 7. INSECTS THAT BITE PEOPLE, PART I: FLEAS

Some insects bother people by biting or stinging. We can often get rid of these without using poisons. Students examine live fleas (in containers) and see what they look like magnified. They learn about the four different life stages of the flea. Using pictures of the life stages of the flea, students practice putting the stages in order and learn some ways to control fleas at each life stage.

Unit 8. INSECTS THAT BITE PEOPLE, PART II: MOSQUITOS AND HEAD LICE

As in Unit 7, students use pictures of the life stages of mosquitos and head lice to practice putting the stages in order and learn ways to help control these insects at each life stage. Creating posters to teach other students about how to safely control fleas, mosquitos and head lice provides a chance to review and be creative with the information learned.



Unit 9. ANTS AND COCKROACHES IN THE KITCHEN

People create environments that insects like. The best way to eliminate and prevent pest problems is to change the environment so that insects can't thrive there. Students brainstorm about what ants and cockroaches need to live (certain foods, water, shelter and entryways). They use this information to identify what promotes insects and how to avoid this through the use of a poster of a "problem kitchen." Students imagine themselves as an ant or cockroach and write a short story about what they would like to find in a home.

Unit 10. PEST MANAGEMENT IN THE CLASSROOM

Many of the pest problems which occur at home are also found in our schools. Everyone can help to keep insects out of the schools. Students use their new pest management knowledge to look for and solve potential ant and cockroach problems in their classrooms, such as by cleaning up food and caulking entrance cracks.

Introduction to Insects

Insects are everywhere. Over half the animals on earth are insects. In California alone, about 30,000 different species inhabit our forests, streams, beaches, fields, deserts and homes. Entomologists have identified about one million species throughout the world, and hundreds of thousands or millions of species still remain unidentified (scientifically, at least). Nonetheless, most people know little about these "insects" that are all around us.

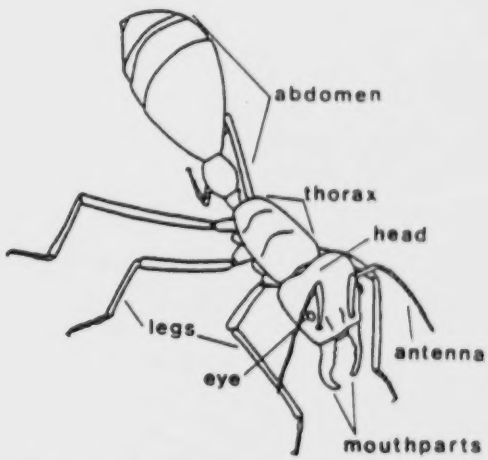
Insects are often confused with other small animals which, while related, are not insects at all. Spiders, millipedes, sowbugs and scorpions are not insects. They belong, along with insects, to a large group of animals called arthropods. Arthropods are invertebrate animals (having no interior skeleton) with segmented legs and bodies. This group includes a great variety of animals from insects to lobsters. What distinguishes the insect from these other animals?

Adult insects can be identified by their six legs and three major body parts:

1) **Head:** Eyes, a pair of antennae, and mouthparts can be found on the head.

2) **Thorax:** This is the middle section, where all six legs are attached. Most adult insects have one or two pair of wings which are also attached to the thorax. (No other arthropods have wings.)

3) **Abdomen:** The abdomen has no legs, but sometimes has egg-laying and mating parts on the hind end.



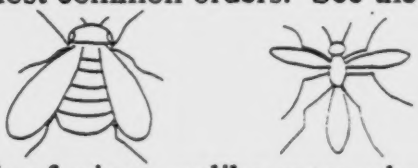
Immature insects, on the other hand, are more difficult to identify, and sometimes seem to have little in common - especially with the adult insects!

There are two primary kinds of insect development. Some insects such as butterflies undergo "complete metamorphosis." The adult insect lays eggs. Worm-like larvae (such as caterpillars or grubs) hatch from the eggs. The larvae shed their skins a certain number of times as they grow. At the final stage the outer skin hardens into a tough shell. Sometimes the larva weaves the shell from silk made in its own body. The larva is now called a pupa. As a pupa, it gradually develops into an adult insect. When the change is complete, the adult emerges, ready to reproduce.

The second type of insect development is called "gradual metamorphosis." Tiny young that look much like the adults hatch from the eggs. These young are called "nymphs" and do not have fully developed wings. They shed their skins as they grow, as do larvae. There is no pupal stage, and after a certain number of sheddings or "moltings," the young become adults. Adults usually have fully developed wings and are able to reproduce.

Insects are divided into over thirty different major groups, called orders. Following is a brief description of the four most common orders. See the resource section for more information.

Flies and Mosquitos *(Diptera)*



Adult flies and mosquitos have only one pair of wings, unlike most other winged insects which have two pair. Flies undergo complete metamorphosis, from the larva (or maggot) to the adult. Some flies or gnats are parasites (living on or in other organisms), some eat plants and some eat other organic materials. Some insects in this order can carry diseases.

Beetles *(Coleoptera)*

Beetles have two pair of wings. The front pair form a hard covering and meet in a straight line down the back of the beetle. The hind pair rest folded under the front pair and are used for flying. Different beetles feed on everything from plant material to other insects. They go through complete metamorphosis.

Butterflies and Moths *(Lepidoptera)*

These insects have two pair of wings covered with tiny overlapping scales, which are easily rubbed off. These insects undergo complete metamorphosis. Most caterpillars (larvae) feed on plant material. Adults sometimes feed on nectar and may be short-lived.

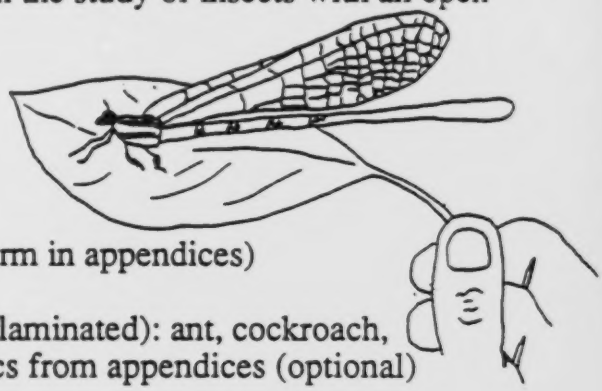
Bees, Wasps and Ants *(Hymenoptera)*

Some adults in this order do not have wings except in the mating stage. Those with wings have two pair of membranous wings (clear and thin). Most have a very narrow "waist" between the abdomen and thorax. Many of these insects live in large colonies. Feeding habits vary from nectar and pollen-eating bees to predaceous or parasitic wasps.

UNIT 1: INTRODUCTION TO URBAN INSECTS

Purpose

The primary purpose of this unit is to introduce students to insects and to get students interested in learning about insects. Using the slide show and insects in the school yard, students can begin to familiarize themselves with which organisms in their environment are insects. Discussion of both the positive and negative effects insects have on people will help students approach the study of insects with an open mind.



Materials

- slide show and script (order with the form in appendices)
- one copy each (preferably colored and laminated): ant, cockroach, mantid, lady beetle, caterpillar graphics from appendices (optional)
- magnifying lenses (optional)

Preparation

- Review the slides and script.
- Find an area on the school grounds for the students to observe insects.
- Color (optional) and laminate the five graphics mentioned above.

Concepts

INSECTS AND OTHER ARTHROPODS ARE INTERESTING AND IMPORTANT CREATURES.

- Insects come in many different shapes, sizes and colors.
- All adult insects have three main body parts; head, thorax and abdomen. The head contains the eyes and antennae. The thorax has six legs and sometimes wings. The abdomen contains the insect's stomach and reproductive parts.

SOME INSECTS ARE HELPFUL; SOME INSECTS CAN BOTHER PEOPLE.

Program

INTRODUCTION: Show the insect slide show to get students thinking about what insects are. Encourage discussion during the show. (See script for introduction to slides.)

DISCUSSION: Establish that insects provide food for birds, frogs, fish and other animals. Insects "help" us. (Bees provide honey, dragonflies eat mosquitos and flies. Bees and butterflies pollinate crops and flowers so plants can produce seeds and reproduce.) Insects are beautiful and interesting.

- What is an insect; name some insects you know; what's the difference between an insect and a spider [spiders have eight legs, two body parts (a head and abdomen), and no wings];

- How are insects like people (they have eyes, legs, etc; they breath air, drink water, need shelter to protect them, reproduce after mating between males and females); how are insects different from people (insects have a hard outer shell instead of skin and they have no bones, they lay eggs and have wings)

- What do insects do (crawl, fly, eat, look for shelter, reproduce); how are they interesting; why do people "need" them (without insect pollination many of our crops would not reproduce and could not be grown; insects break down dead plants so nutrients can be recycled for new plant growth; they control pest insects; they produce honey, wax, shellac and silk); why do other animals/plants need insects (for food, pollination);
SEE UNIT 3 FOR MORE DISCUSSION OF SOME OF THIS.

ACTIVITY: Have students go out in pairs or groups onto the school grounds to look for and observe any insects they find. Help the students find and ask questions about insects. Encourage them to spend a few minutes looking closely just at one insect.

- We are now going to <u>quietly observe</u> insects;

- Do not touch the insects, just look;

- Try to notice at least one thing about the insect you observe (does it have wings, what is it doing).

WRAP-UP:

- What kinds of insects did you see?

- What did you notice about the insects; what were they doing?

- Name some helpful insects.

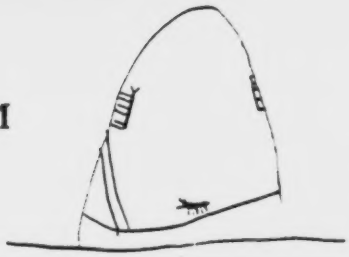
- Name some insects that bother us.

FOLLOW-UP ACTIVITIES:

1. Have students look for insects in their own homes or yards and draw a picture of them, look at what they are doing. Some students may want to bring in insects that they find to share with the class.

2. Bring in an insect that you can feed, and watch its development (e.g. any caterpillar). See resource section for information on insects you can raise in the classroom.

UNIT 2: LIVE INSECTS IN THE CLASSROOM



Purpose

The purpose of this unit is to allow students to touch and see some live insects. This may begin to teach students that they do not need to fear insects, and will also continue to raise their interest in insects.

Materials

- live insects in escape-proof containers (beetles, grasshoppers, praying mantids; see resources for possible sources of insects and naturalists)

- magnifying lenses (optional)

Preparation

- Contact someone to bring in insects and talk about them; OR

- Order live insects from a beneficial insect supplier or a biological supply house (see appendices); OR

- Catch insects yourself by attracting them to a light at night, turning over rocks, beating a branch into a plastic bag (see resource section). Find out some general information about each kind (four or five species to look at works best).

Concepts

INSECTS ARE INTERESTING LIVING ANIMALS.

- Many insects have four different life stages; not just butterflies start as caterpillars. (Introduce this only if there are several life stages of an insect available to look at. See "Introduction to Insects" for information.)

Program

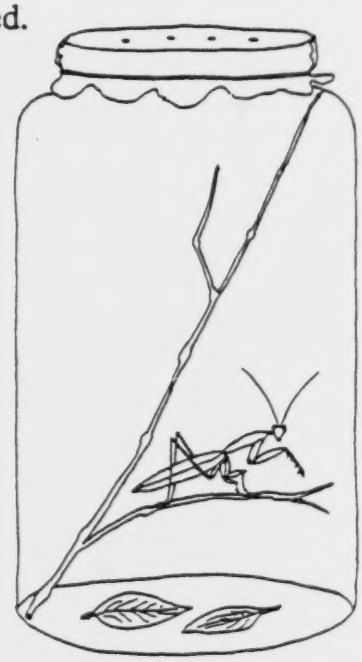
INTRODUCTION: Review the different parts that insects have. Talk about insects that students saw at home. Introduce the insects that you have brought in, highlighting points of interest for each. Include information on how the insect may positively or negatively affect people (if relevant).

DISCUSSION: Find out what students know about each insect as you introduce them. Help students figure out where the insects live, what they eat, etc.

ACTIVITY: Set up 3-5 tables, each with a different insect, and preferably an adult to explain and encourage observation. (Alternatively the naturalist or teacher can wander from table to table explaining.) Have students look at each insect for 5 minutes, then rotate to the next table. If there is time, have students draw a picture of one of the insects. Help students work on drawing accurate body parts (six legs, antennae, etc.)

WRAP-UP: Discuss each insect and what students observed.

- What was the insect doing?
- Does it have wings; did you see it fly?
- How many legs does it have?



FOLLOW-UP ACTIVITIES:

1. Copy one or several of the curriculum insect graphics for the students to color. Students can also research the insect and write a short report (a few sentences) about the insect.

UNIT 3: INSECTS IN THE "CHAIN OF LIFE"

Purpose

The purpose of this unit is to introduce the concept of the "chain of life," or the balance that is maintained among all the organisms (including people) in our environment. Insects are an integral part of that chain. Life as we know it would be completely different without insects. This unit introduces the terms "predator," "prey" and "decomposer," three important roles which insects play in the ecosystem.

Materials

- drawing paper
- crayons
- medium weight string (40 - 50 feet long)
- scissors

Preparation

- Gather the above materials.
- Cut two small slits in the upper corners of each student's piece of paper, so that it can be strung on a string.
- Think through a hypothetical "chain" to aid in story-telling.

Concepts

INSECTS ARE AN ESSENTIAL PART OF THE "CHAIN OF LIFE"

- insects provide food for many animals (they are prey)
- insects catch and eat other insects (they are predators)
- insects feed on dead plants and animals and return nutrients to the soil (they are decomposers)
- insects are essential for the pollination of many plants

Program

INTRODUCTION: Review some of the reasons insects are important (UNIT 1), focusing on their role in the ecosystem (serve as food to animals, help eat some insect pests, essential to pollination). Introduce and explain the following three terms:

> Predator: an animal which catches and eats other animals.
>
> Prey: an animal which is caught and eaten by other animals.
>
> Decomposer: an animal which feeds on dead plants and animals, helping the organism to rot and return its nutrients to the soil so that other plants can grow.

DISCUSSION: Have students give examples of animals (including insects) that are predators, prey or decomposers. Help students understand how insects fit into the "chain of life," and how the chain would be broken if there were no insects, especially since insects make up such a large percentage of the animal kingdom. Help students understand that when some of the insects are destroyed many other plants and animals are affected.

- How many different kinds of insects do you think there are? (more than a million)

- What would happen if there were no longer any insects in the world? (many flowers would no longer be pollinated and would not be able to make seeds:; many animals would have no food; many plants (food crops and weeds) would no longer be eaten by insects . . .)

ACTIVITY: Tell the students you will play a story-telling game about the "chain of life." Break the class into two or three parts, with an adult leader in each group. Each group will create its own "chain of life" in the form of a story, beginning with an insect prey (feeding off a plant) and ending with an insect decomposer. Each person in the group will be a different animal, and will tell their part of the story (how they caught and ate the animal before them).

FOR EXAMPLE:

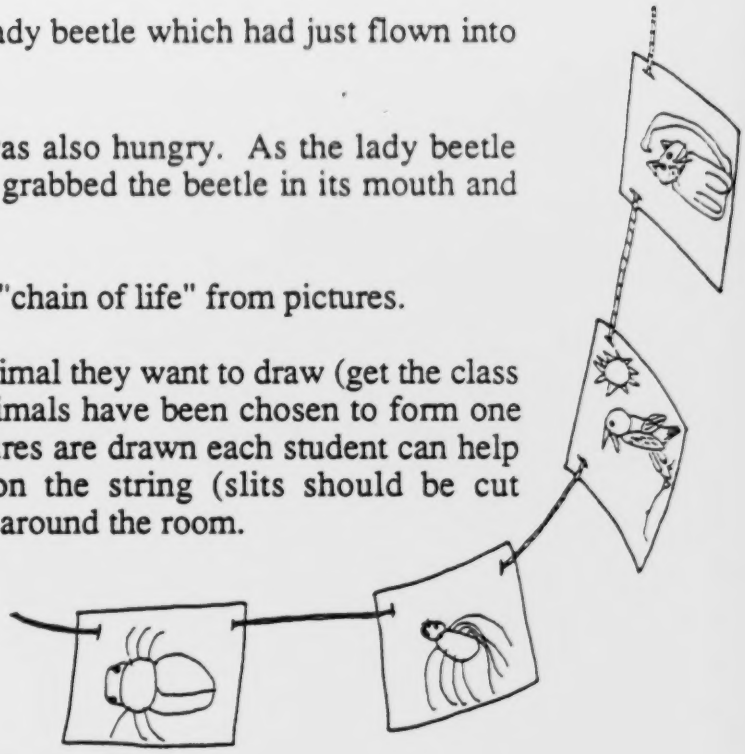
1st speaker: Once upon a time there was a little green aphid sitting on a rosebush sucking juices from the leaves.

2nd speaker: Along came a hungry lady beetle which had just flown into the yard. It ate the aphid.

3rd speaker: A bird in the garden was also hungry. As the lady beetle flew by, the bird swooped down and grabbed the beetle in its mouth and swallowed it. . . .

ACTIVITY: The students will create a "chain of life" from pictures.

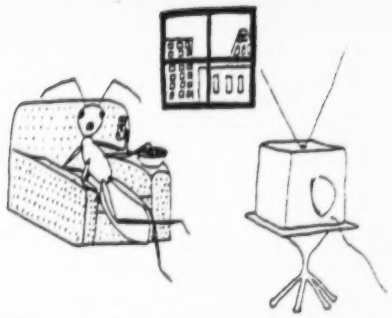
Each child in the class chooses one animal they want to draw (get the class to help decide if enough different animals have been chosen to form one or several chains.) After all the pictures are drawn each student can help hang his or her picture in order on the string (slits should be cut beforehand). This chain can be hung around the room.



WRAP-UP: Help the kids review what they can teach their families and other kids about the importance of insects.

FOLLOW-UP ACTIVITIES:

1. Create an insect with materials that students bring in. Make sure the insects have three main body parts (egg carton cups, walnut shells, other materials), six legs attached to the thorax (pipe cleaners, spaghetti noodles, wire), wings (material, gauze, paper), two antennae attached to the head, and two eyes (screen or netting can be cut in circles to simulate compound eyes).



UNIT 4: CITY INSECTS

Purpose

The purpose of this unit is to teach students that people affect insects - often in a negative way by destroying the places insects live or the plants and animals they feed on. Insects are just as important in maintaining an ecological balance in urban areas as in natural areas. But if we want insects to share and decorate our urban environment, we must make sure their needs are met.

Materials

- butcher paper
- crayons, paints or pencils
- drawing paper
- tape
- chalk and chalkboard

Preparation

- Find a paved area and a weedy/vegetated area for the students to look for insects.
- Gather the above materials.
- (opt.) Sketch in a "city skyline" background for the mural.

Concepts

INSECTS AND OTHER PLANTS AND ANIMALS MAKE CITIES BEAUTIFUL AND INTERESTING TO LIVE IN.

WE NEED TO SAVE AND CREATE PLACES FOR INSECTS TO LIVE.

- Insects disappear because there aren't enough places for them to live in a city (insufficient food, shelter).
- Some insects can't live in places that are very polluted or have been sprayed with chemical pesticides.

Program

INTRODUCTION: Review some of the reasons insects are important. Focus on some of the personal reasons students like to have insects around (beautiful to look at, interesting, like having birds around, which often feed on insects).

DISCUSSION: Once students are thinking about why insects are important, introduce the idea that many insects can't live in certain places anymore, and are even disappearing. Discuss some of the reasons for this and what individuals might be able to do.

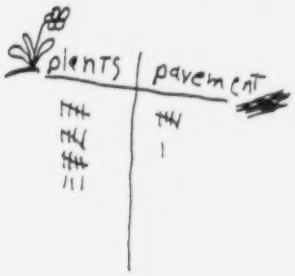
- Where would we look for insects outside? (roads? parks? gardens? sidewalks?)

- Why do you think we find more insects in some areas than others? (food and shelter available)

- Why do some insects have a hard time living in a city? (not enough different kinds of plants and animals for food and shelter; too much pollution; people spray their roads and gardens with poisons to kill "bad" insects; many insects kill themselves on lights; no open streams or ponds for feeding and breeding)

- Can you think of some ways we could help out? (plant many different plants in garden, especially native plants that local insects may feed on; flowering plants may attract butterflies and other insects that feed on nectar; don't leave on too many outside lights; create more natural parks.)

ACTIVITY: Tell students they are going to sample the difference between the number of insects found in paved areas and those found in planted areas. Divide the class into 2 (or 4) groups. Send half of the class to count insects in a paved area (playground, basketball court). Send the other half to an area with weeds and vegetation. When all the groups return to the classroom, have each group report the number of insects they saw, and if possible, the number of different kinds. Record these in two columns. If insects are found in the paved area, help students to speculate on whether those insects are living there or whether they were just passing through. Is there any food the insects might find there?



ACTIVITY: In this activity, the students will prepare a mural. This can be done in several ways.

1) If there is enough time, have half the class draw their homes and other buildings as a background onto half the mural. Meanwhile the other students will draw, color and cut out insects they would like to have in their city. These will eventually be pasted onto the mural. Switch places when students are ready.

2) If there is not much time, assign half the class to preparing the background and half to drawing insects.

3) The third option is to sketch or prepare a "city skyline background" on a mural or bulletin board. The students can then spend their time drawing their insects.

WRAP-UP: Review some of the things we should do to make sure insects have a place to live.

FOLLOW-UP:

1. In the spring time, have the students plant some native flower seeds to transfer to their own gardens or to the school grounds, to attract insects.

2. (Preparation for UNIT 5) Have the students cut out ads, pictures, or comics with insects in them from magazines and newspapers at home. This may work best if the students are given a "homework" sheet to paste the pictures onto, or which at least explains what is needed. The "homework" sheet can also include a review of insect parts, etc.

UNIT 5: INSECTS AND THE MEDIA

Purpose

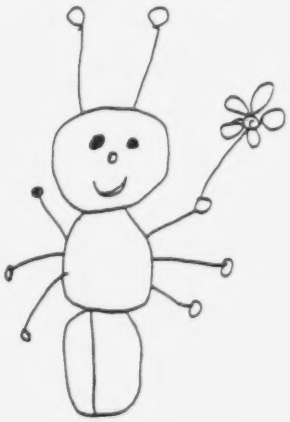
The purpose of this unit is to help students understand the difference between the media's image of insects and insects in real life. We are often taught that insects are nasty. This unit should teach students that insects can be made to look mean or friendly. Older students will also be introduced to the concept of telling a story with pictures.

Materials

- photos and cartoons of insects (brought in by students and teacher; see UNIT 4 follow-up)
- cartoon graphics from curriculum
- paper, crayons and/or pencils

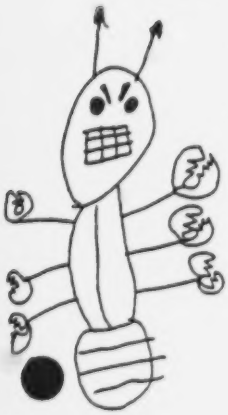
Preparation

- Gather a few cartoons that you are sure to be able to use to make concepts clear (like a comic strip with insects that tells a story).



Concepts

CARTOONS CAN MAKE INSECTS LOOK FRIENDLY OR MEAN.



- Cartoons are pretend.
- Magazines and T.V. shows often use cartoons to make insects look mean.

Program

INTRODUCTION: Tell the students that you are going to talk about pictures of insects. Discuss the difference between pictures that are "real" and those that are "pretend" (accurate line drawings should be considered real).

ACTIVITY: Collect the insect pictures that the students have brought in. Have the students help you categorize them into "real" and "pretend." Have the students point out what isn't "real" in the cartoon (faces, clothes, too many legs, etc.)

DISCUSSION: Look at some of the cartoons to see if insects look mean or friendly. (If there are enough, categorize these into "mean" and "friendly" cartoons.) Discuss how cartoonists make the insect look mean or friendly (facial expression, claws, what the insect is doing). A simple drawing on the board can help illustrate this.

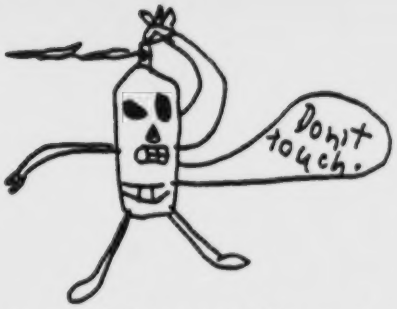
ACTIVITY: Have students draw a comic strip with friendly insects (to show that insects do not always have to be portrayed as bad or monstrous). The paper can be folded in four parts, with each section numbered. Explain that comic strips tell a story (use example). Brainstorm ideas with the students about funny things a pretend (cartoon) insect might do (e.g. go to school, play games, etc.). Older students could incorporate some of the beneficial roles insects play, which they learned about in the first four units. (Have younger students simply draw a friendly insect and a mean insect.)

WRAP-UP: Have several students come forward and share their cartoons. Encourage kids to look for real and pretend cartoons on T.V.

FOLLOW-UP:

1. Have the students help paste insect pictures they brought in into real and pretend columns on a piece of butcher paper. For older students this can be done to form a bar graph that compares the numbers of real or pretend pictures brought in.

UNIT 6: PESTICIDES ARE POISONS



Purpose

The purpose of this unit is to teach students that pesticides are dangerous poisons. Students should also learn to recognize some of the other poisons in their homes. Students get practice in thinking through the best ways to protect themselves, their pets and their families from these poisons. This unit was adapted from a unit in "Toxics in Your Home? You Bet!" a curriculum on household toxics by the Golden Empire Health Planning Center (see resource section).

Materials

- 5 or more "safe" household items (containing no toxic chemicals) e.g. pots, cereal box, cracker box, fruit, book, cup)

- 5 or more toxic household items (at least 3 pesticides) such as flea powder, roach or ant spray, flea collar, weed killer, detergents, furniture polish)

- safety label graphics from appendices

- paper and crayons

- parent letter in appendices (see follow-up)

Preparation

- Gather together the above materials.

- Clear off a high place in the classroom where toxic substances can be placed during the activity.

Concepts

PESTICIDES ARE POISONS AND THEREFORE CAN HURT PEOPLE.

- We should try not to use pesticides.

- Pesticides and other household toxics should be kept in high places or locked cupboards.

- Safety labels warn people about dangerous substances.

Program

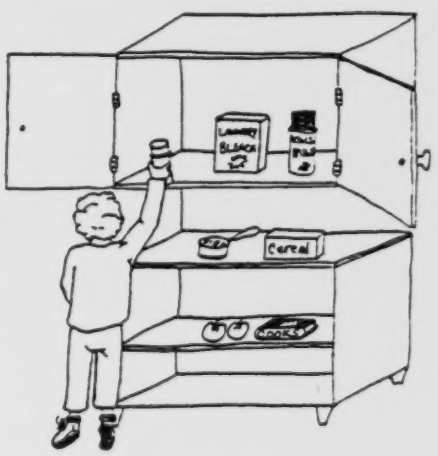
INTRODUCTION: Although pesticides are made to kill bugs that bother us, they often also kill bugs that are important and that we like. They can make people and pets sick if we accidently eat, breath, or touch them. Introduce the idea that there are other ways to control pests.

DISCUSSION: Help the students understand that a poison that can kill insects can also kill or hurt other living things, like people. Pesticides can cause rashes, dizziness, headaches, nausea, stinging eyes, as well as long term effects. Because pesticides are dangerous, people should try not to use them.

- How can pesticides or poisons hurt us?

- Where should they be stored safely (to protect younger brothers and sisters and pets)?

ACTIVITY: Have individual students come forward. Give the student an object and have her or him tell the class if the object is safe or poisonous, what it is, and where it should be stored. Dangerous objects should be placed on the high shelf; safe objects can be placed on a lower table. Students who can read can look for warning words on containers.



ACTIVITY: Have the children create safety labels for dangerous pesticides. First brainstorm warning words and write them on the board. Brainstorm ideas for warning symbols. Encourage them to create their own warning symbols. Younger children can draw a scary face that would show people that the substance is dangerous. Teachers can write warning words on the picutres.

WRAP-UP: Have children share their safety labels with the rest of the class.

FOLLOW-UP ACTIVITIES:

1. Send the "poison-proofing" letter (in the appendices) home to parents. Encourage children to help their parents "safety-proof" their home. On the following day, discuss what the children did.

UNIT 7: INSECTS THAT BITE PEOPLE, PART I: FLEAS

Purpose

The first purpose of this unit is to teach students that fleas are insects and have things in common with other insects (they have six legs, antennae, etc., they have four life stages, like a butterfly). Students can recognize the body parts by examining live fleas. Secondly, students should learn that it is possible to control fleas without poisons, and learn about some of those specific techniques.

Materials

- 5 jar lids, 5 pieces of cellophane, 5 rubber bands (or alternatively, 5 petri dishes)

- approximately 30 fleas

- magnifying lenses

- flea graphics from appendices

Preparation

- Catch and distribute the fleas into jar lids. (Fleas can be combed off of pets with a flea comb and dropped into a jar. This should be done outside.)

- Color and laminate the flea graphics.

- Familiarize yourself with the flea control fact sheet (see appendices).

Concepts

SOME INSECTS (LIKE FLEAS) BOTHER PEOPLE BY BITING OR STINGING. WE CAN CONTROL THEM WITHOUT USING POISONS.

- Fleas, like many insects, have four life stages (egg, larva, pupa, adult).

Program

INTRODUCTION: Review poison-proofing at home and the importance of using poisons as little as possible. Tell the students that you brought in some animals for them to observe. Do not tell them what the animals are. Go straight to the activity.

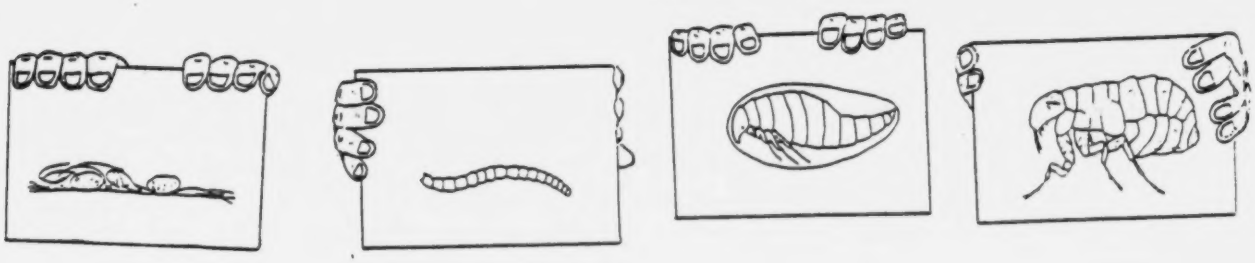
ACTIVITY: Divide the students into five groups. Give each group a container of fleas, magnifying lenses, and a sheet with the following questions (or write the questions on the blackboard). Have the students observe the fleas with their magnifying lenses and answer the questions.

1. What color is this animal?
2. How many legs does it have?
3. Is it an insect?
4. What is this animal doing?
5. Where do you think it lives?

DISCUSSION: Discuss the answers to these questions and what the students saw.

- Do you know what this insect is?
- What do fleas eat? (adult fleas suck blood from animals for food; that is why they bite us)
- How can we control fleas without using poisons? (see flea fact sheet)
- Review the four life stages of insects.

ACTIVITY: See if students recognize the four life stages of the flea, using the flea graphics from the appendices. As each stage is identified, have a student come hold the pictures in front of the class. When all four stages are being held up, have another student come up and put the four students, each with one life stage, in the correct order. Discuss pest management techniques for each life stage (see the flea control fact sheet in the appendices for details)



Flea pest management:

- Shampoo pets or comb with special flea comb.

- Wash pet bedding regularly (eggs laid here).

- Clean dusty corners (where larvae live).

ACTIVITY: Have a few students practice being a "Flea Control Helper." Have another student (or yourself) be a person with flea problems, and ask the "Helper" what to do. The class can help out. This is a good way to review the management techniques.

WRAP-UP: Have the students discuss what they can do in their own homes if they have a flea problem. Encourage them to share what they have learned with their parents and friends.

FOLLOW-UP ACTIVITIES:

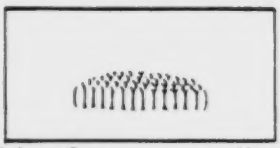
1. Copy the flea life stage graphics so that each student has a complete set. Write the life stage name on each picture and staple them in order. Pictures can be colored. Older students can write pest management techniques on the back of the appropriate life stages.

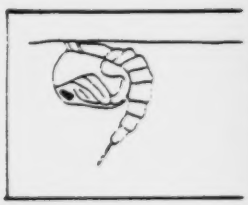
2. Have the students research other insects that have four life stages. Draw the four life stages in order.

UNIT 8: INSECTS THAT BITE PEOPLE, PART II: MOSQUITOS AND HEAD LICE

Purpose

The purpose of this unit is to continue to teach students about some of the pest insects they are familiar with, and to get them to think about ways to control them without using poisons. A second purpose of this unit is to help remove some of the stigma of having head lice, by teaching students about head lice and getting them to talk about head lice. Students will also learn how to avoid spreading head lice, which will help cut down on the head lice cases.





Materials

- mosquito and head lice graphics from appendices
- large size paper (for posters)

Preparation

- Laminate the graphics.
- Familiarize yourself with the head lice and mosquito control fact sheets in the appendices.

Concepts

SOME INSECTS, LIKE MOSQUITOS AND HEAD LICE, BOTHER PEOPLE BY BITING OR STINGING. WE CAN CONTROL THEM WITHOUT USING POISON.

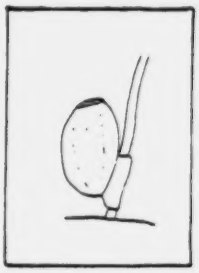
- Mosquitos have four life stages, like the flea (egg, larva, pupa, adult).
- Head lice, like some other insects, have only two obvious life stages (egg and adult). The nymph (intermediate stage) closely resembles the adult.

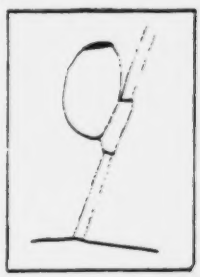
Program

INTRODUCTION: Review the life stages of the flea. Review safe control methods.

DISCUSSION: Have the students think of and discuss some of the other insects that bite people (mosquitos, head lice and ticks - not an insect - suck animal blood for food; ants, wasps and spiders - not an insect - bite or sting people to protect themselves; bees sting people in self protection, using a special organ on the abdomen).

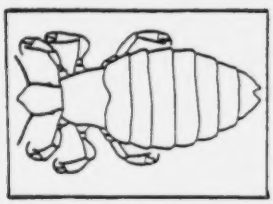
ACTIVITY: See if the students can recognize the mosquito adult graphic. Introduce the life stages as with the flea in UNIT 7, and have them put the stages in order. Discuss pest management techniques for each life stage (see mosquito and head lice control fact sheets in appendices for details). Repeat this with the head louse. Explain that the head louse does not have four obvious life stages; there is no larval or pupal stage. The young head louse looks much like the adult, and sheds its skin a few times as it grows into an adult.





Mosquito pest management:

- Screen windows to keep adult mosquitos out.
- Remove objects containing water (where eggs are laid).
- Special fish eat mosquito larvae in ponds.



Head lice management:

- Comb lice and eggs from hair with special comb.
- Don't share hats and combs.

Questions: How do head lice move around? (They cannot jump or fly; they crawl.) How can we avoid sharing head lice? What does it feel like to have head lice? (Itchy; let your teacher or parent know if you feel itchy around your ears or neck.) We can use magnifying lenses to see head lice.

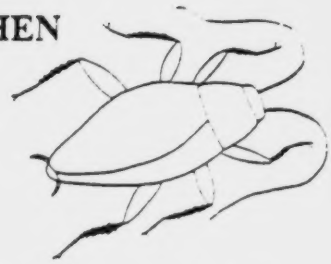
ACTIVITY: Have the students pick one of the three biting insects studied and create a poster to teach their friends and family a little about how to control the animals without poisons. Post these in the classroom and hallway.

WRAP-UP: Remind the students that we can control many of these insects without using poisons. Encourage them to share what they have learned with their parents and friends.

FOLLOW-UP ACTIVITIES:

1. Copy the life stages of the mosquito or head louse so that each student has a complete set. Write the life stage name on each picture and staple them in order. Pictures can be colored. Older students can write pest management techniques on the back of the appropriate life stages.

UNIT 9: ANTS AND COCKROACHES IN THE KITCHEN



Purpose

The purpose of this unit is to teach students that people create environments that some insects like, so that the insects become a problem. Students should begin to recognize some of the things in their home which might attract ants and cockroaches to live there, and think through some of the things they can do to fix the problems.

Materials

- large poster of problem kitchen (put together from four pieces in appendices)
- 30 red arrows cut from construction paper
- tape or stickum putty to attach arrows to poster
- lined writing paper

Preparation

- Put together the kitchen poster.
- Cut out arrows and attach tape to each one.
- Familiarize yourself with the ant and cockroach control fact sheets in the appendices.

Concepts

PEOPLE CREATE ENVIRONMENTS THAT INSECTS LIKE. BY CHANGING THE ENVIRONMENT WE CAN CONTROL PEST PROBLEMS WITHOUT USING POISONS.

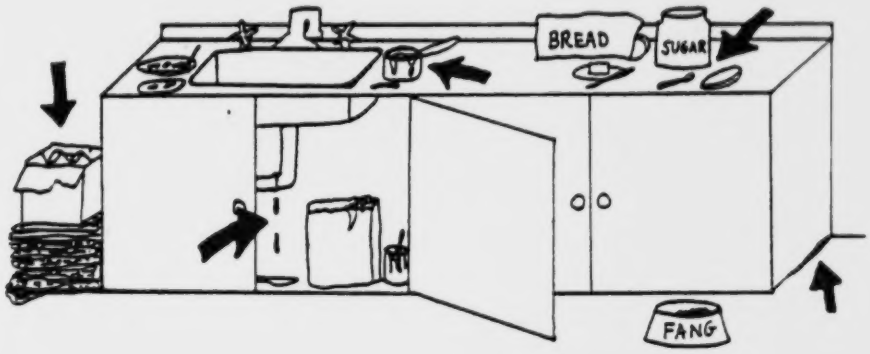
- Ants and cockroaches need food, water, shelter and entryways.

Program

INTRODUCTION: Review insects that bother us in our homes or schools.

DISCUSSION: Discuss ants and cockroaches separately, making different lists on the blackboard of food, drink, home, and entry for each. Leave these words on the blackboard for use in the writing activity.

ACTIVITY: Have individuals mark potential pest problems on the kitchen poster with red arrows, and then suggest solutions. Introduce caulk as a way to fill cracks.



ACTIVITY: Have the students write a "short story" as if they were an ant or cockroach, surveying a classroom or house as a potential new home. For younger students, write a model sentence on the board for them to copy, fill in, and illustrate: "I am a _____. I am happy to find _____ in my new home."

WRAP-UP: Have the students share their stories with the rest of their class.

FOLLOW-UP ACTIVITIES:

1. Copy the small kitchen graphic in appendices for all of the students. Have the students circle problems in the kitchen, or draw ants and cockroaches where there are problems.

2. Create your own ant trail with pieces of paper (leading to a snack), which the students can then follow as if they were ants.

3. Have the students look for and solve problems at home, then share these in class.

UNIT 10: PEST MANAGEMENT IN THE CLASSROOM

Purpose

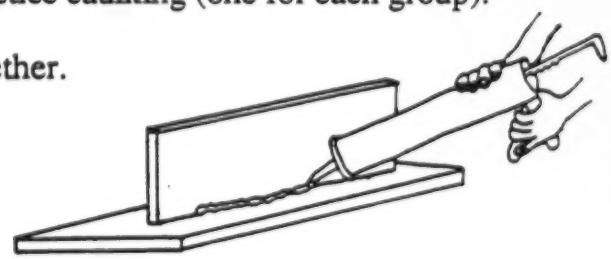
The purpose of this unit is to apply the concepts learned in UNIT 9 to potential classroom ant and cockroach problems. Students will learn that they can help out with some of the school's pest problems through hands-on experience.

Materials

- 4 sponges, 4 rags
- 4 containers with soapy water
- 4 tubes of caulking or caulking guns with caulk
- 8 boards (approx. 2' x 6" x 1"), hammer, nails
- 30 arrows cut from red construction paper (see UNIT 9), with tape
- instructions for adult leaders on what to look for (in appendices)

Preparation

- Review the ant and cockroach control fact sheets in the appendices.
- Nail pairs of boards together perpendicularly to form a crack on which the students can practice caulking (one for each group).
- Gather materials together.



Concepts

WE CAN ALL HELP KEEP INSECTS OUT OF THE SCHOOL, WITHOUT USING PESTICIDES.

- Cracks can be filled with caulk to keep ants and cockroaches out.
- Food and crumbs can be cleaned up so we don't provide food to insects.

Program

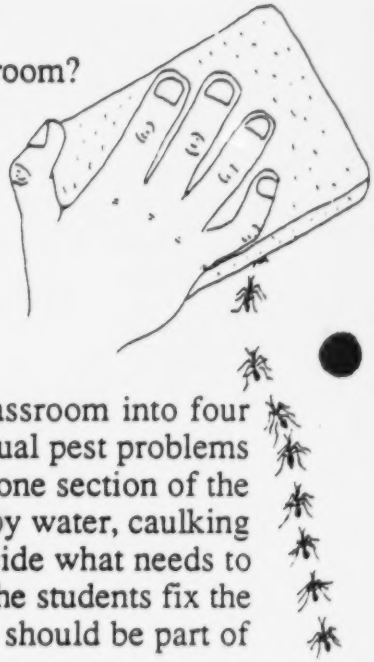
INTRODUCTION: Review possible food, water, shelter and entry sources for ants and cockroaches. Lists can be written on the blackboard. Tell the students that they will be helping with ant and cockroach problems in the classroom.

DISCUSSION: Review some solutions to potential pest problems: 1) plugging up holes or cracks through which pests enter the building; 2) making sure all areas are kept clean (no food crumbs) and dry (especially the sink area). Help the students understand that these solutions will work at home as well.

- How might insects get into this classroom?

- Where might ants or cockroaches find food in this classroom?

- What can we do to prevent these problems?



ACTIVITY: Divide the students into four groups. Divide the classroom into four sections (or another part of the school if you are familiar with actual pest problems somewhere). Each group will have an adult leader, and be given one section of the classroom, along with a set of pest control tools (sponge, rag, soapy water, caulking tools). Look for insects. Look for places insects might like. Decide what needs to be done to "pest-proof" that area. If the solution is feasible, have the students fix the problems (e.g. clean-up or simple caulking). Ideally, a custodian should be part of this process.

WRAP-UP: Have each group share what they did in their section. Discuss ways that students can teach other students in the school about keeping ants and cockroaches out of the school.

FOLLOW-UP ACTIVITIES:

1. Have the students design and make posters to inform other students in the school about how they can help keep pests out of the school, or out of specific areas such as the cafeteria.

RESOURCES
ON INSECTS AND INTEGRATED PEST MANAGEMENT

Books and Publications

CAROLINA ARTHROPOD MANUAL. 1982. Carolina Biological Supply Co. Burlington NC. 35 pp.

Cowles, Kathleen Letcher; Deborah Miller and Toby Stewart. 1983. *SAFE COCKROACH CONTROL: A GUIDE TO SETTING UP AN INTEGRATED PEST MANAGEMENT PROGRAM WITHIN A SCHOOL SYSTEM.* John Muir Institute, Inc. (see curricula by same author for address)

Gray, Alice. 1976. "Terrestrial Arthropods in the Elementary Classroom," *THE AMERICAN BIOLOGY TEACHER.* April pp. 211-215.

Haguenoer, Michel. 1975. *WORLD TREASURY OF INSECTS IN COLOR.* Galahad Books, New York. 110 pp.

National Audubon Society. 1981. *GETTING THE BUGS OUT. A GUIDE TO SENSIBLE PEST MANAGEMENT IN AND AROUND THE HOME.* New York.

Sauer, Richard. 1976. "Rearing Insects in the Classroom," *THE AMERICAN BIOLOGY TEACHER.* April pp. 216-221.

Simon, Hilda. 1971. *OUR SIX-LEGGED FRIENDS AND ALLIES: ECOLOGY IN YOUR BACKYARD.* The Vanguard Press, Inc. 96 pp.

Stokes, Donald. 1983. *A GUIDE TO OBSERVING INSECT LIVES.* Little, Brown and co., Boston.

von Frisch, Karl. 1978. *TWELVE LITTLE HOUSEMATES.* Pergamon Press, Inc. 146 pp.

Zahradnik, Jiri. 1977. *A FIELD GUIDE IN COLOR TO INSECTS.* Octopus Books Limited, London. 319 pp.

Organizations

Bio-Integral Resource Center
P.O. Box 7414
Berkeley, Ca. 94707
(415) 524-2567

Provides detailed practical information on the least toxic methods for managing pests.

California Department of Food and Agriculture
IPM Program
Environmental Monitoring and Pest Management Unit
1220 "N" St.
Sacramento, Ca. 95814
(916) 322-2395

Provides information on integrated pest management (IPM).

Citizens for a Better Environment
942 Market St., Suite 505
San Francisco, Ca. 94102
(415) 788-0690

Provides information on non-toxic pest control and on integrated pest management policies being used in Bay Area Communities.

National Audubon Society
950 Third Ave.
New York, NY 10022

Publishes several informative study brochures on insects.

National Pediculosis Association
P.O. Box 149
Newton, MA 02161
(617) 499-NITS

Has resources, up-to-date information and a newsletter on safe head lice control.

Live Insect Sources

County or University Cooperative Extension

County 4-H program

Parks and Recreation naturalists

University biology, entomology or zoology departments

Commercial insect supply companies (see the State of California Department of Food and Agriculture's 1985 list: "Suppliers of Beneficial Organisms in North America") Two companies are listed below for your convenience.

Peaceful Valley Farm Supply, 1173 Peaceful Valley Rd. Nevada City, CA 95959, (916) 264-FARM.

Rincon-Vitova Insectaries, Inc., P.O. Box 95 Oak View, CA 93022, (805) 643-5407.

Related Curricula (A more complete list is available through the Golden Empire Health Planning Center. See *TOXICS IN YOUR HOME? YOU BET!* below.)

THE CASE OF THE WILD HOUSE MOUSE by Kathleen Letcher Cowles

A small teaching packet for elementary schools on non-toxic mouse control. Includes take-home booklets, activities, and a complete bulletin board display.

From: Kathleen Letcher Cowles, John Muir Institute 29 W. High Street (WO) Morgantown, WV 26505, (304) 296-2855.

COCKROACH CLEAN-UP TOUR by Kathleen Letcher Cowles

Teaches the basics of safe cockroach management with humor and facts. Contains eight complete lesson plans, colorful poster set, take home booklets and filmstrip/cassette tape. Targeted for elementary schools.

From: Kathleen Letcher Cowles, John Muir Institute 29 W. High Street (WO) Morgantown, WV 26505, (304) 296-2855.

A GUIDE TO TEACHING POISON PREVENTION IN KINDERGARTENS AND PRIMARY GRADES by the Consumer Products Safety Commission*

Book contains a wide selection of games, pictures, worksheets, and activities designed to assist in teaching poison prevention to children.

From: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

* The Consumer Product Safety Commission (CPSC) has numerous curriculum aids for teaching product safety to children. Contact your regional CPSC office for more information. In California: CPSC, 555 Battery, Rm. 416, San Francisco, CA 94111, (415) 556-1816.

TEACH (TEACHING ENVIRONMENTAL AWARENESS TO CHILDREN OF THE HARVEST) by the Pennsylvania Department of Education

A curriculum targeted for children of farmworkers, to teach them safety skills for living in areas where pesticides are used and stored. Integrates basic reading and math skills. Available in Spanish and English.

From: Joan Ainslie, Health Consultant, California Department of Education, Office of Migrant Education, 721 Capitol Mall, Sacramento, CA 95814, (916) 324-4603.

TOXICS IN YOUR HOME? YOU BET! by Golden Empire Health Planning Center

Introduces students to identifying household toxics, using toxics safely, disposing of toxics safely, and using less toxic alternatives (the K-3 curriculum discusses "look alike" products in lieu of this concept.) Separate curricula have been developed for grades K-3, 4-6, 7-8, and 9-12.

From: Golden Empire health Planning Center, 2100 21st Street, Sacramento, CA 95818, (916) 731-5050.

Integrated Pest Management for

ANTS

The common problem ant in the San Francisco Bay Area is the small reddish-brown Argentine ant (*Iridomyrex humilis*). This ant nests outside under sidewalks, roadways, driveways, boards, stones and building foundations. It feeds on everything from dead and living insects to fungi and plant nectar, and particularly enjoys sweet foods. The Argentine ant is harmless to people, and actually is important in decomposing and returning organic material to the soil.

Ants become a problem indoors because they are looking for food and shelter, especially during the winter, rainy season in California. Although the presence of a few ants should be tolerated, numerous ants can be annoying.

The first step in controlling an ant invasion is to remove all food sources.

- Clean up any food or liquid that has been spilled, keeping floors and counters clean. In classrooms, food should be kept and eaten in only one area, which is laid out so that all furniture can be readily moved and the area easily cleaned.

- Store all food in air-tight, ant-proof containers.

- Store garbage in a sealed container and empty regularly. Lining the cans with plastic bags or newspaper can make them easier to empty and clean. Sweet garbage and other refuse particularly attractive to pests can be wrapped in newspaper before disposal.

Ants sometimes try to nest in potted plants. These pots (and their saucers) can be placed in a pan of water which is filled whenever plants are watered. This safe and easy "moat" technique can also be used to exclude ants from tables with plants or food by placing the table legs in a small dish of water. Even the garbage can be protected this way, by putting the garbage can on a small stool with its legs in moats.

Another essential step is to make it difficult for ants to find their way into your home or school in the first place. Argentine ants send out "scouts" to look for food. These scouts lay down a pheromone (chemical scent) trail which the other ants can follow to the food source. By following the trail you can discover where the ants are coming in and then:

- Seal up ant entryways with plaster, putty, caulk, or vaseline (least effective). Check cracks around windowsills, thresholds, baseboards, cupboards and drawers when you are looking for entryways.

- Wipe up the ant trail with a weak bleach solution to erase the pheromone scent.

Ants can also be a problem outdoors by protecting aphids, which the ants "milk" for the "honeydew" or sweet body secretions that aphids produce. When numerous, aphids can be a pest in the garden because they damage plants by sucking out the juices. Ants can be kept from protecting the aphids by keeping them off the trees or bushes with a barrier of "Tangle-Foot" or "Stickem" around the trunk. When applied in a one inch wide band about 1/8 inch thick, the ants cannot cross this barrier. The barrier substance should be scored from time to time to keep its surface sticky. Soap sprays (such as Safer Agro-Chem Insecticidal Soap) can be applied to suppress ant-attracting aphids.

Integrated Pest Management for

COCKROACHES

Like all other animals, cockroaches require food, water and shelter in order to survive. Reduce or remove these and the insects cannot continue to live. Knowing something about cockroach habits and biology will help you figure out how to suppress their populations.

The German cockroach (*Blattella germanica*) is the most common pest species. It is about 1/2 inch long and lives for 2 to 8 months. It prefers being in warm moist areas (such as under or behind stoves or refrigerators) where food is readily available. The female carries her egg case until just before the eggs hatch. The San Francisco Bay Area's other most common species is the brown-banded cockroach (*Supella longipalpa*) which glues its egg cases to furniture or other surfaces and is generally found in high places in cupboards, pantries or behind pictures. Cockroaches undergo gradual metamorphosis, changing from young to adults with no pupal stage.

Food: Cockroaches eat just about anything people eat - and more. They prefer starchy and sweet foods. They will also sip milk, nibble at cheese, meats, pastry, grain products, as well as starch-based paints, wallpaper paste, glue and soap. They feed primarily at night.

The further cockroaches have to travel for their food, the less energy they have available for reproduction. The first important step in cockroach control is to remove all potential food sources:

- Clean up any food or liquid that has been spilled, keeping floors and counters clean. In classrooms, food should be kept and eaten in only one area, which is laid out so that all furniture can be readily moved and the area easily cleaned.

- Store all food in air-tight, cockroach-proof containers. Containers should be metal, glass or plastic, since cockroaches can eat through cloth or cardboard.

- Garbage should be stored in tight-sealing cockroach-proof containers and should be emptied regularly. Sweet garbage and other refuse particularly attractive to pests can be wrapped in newspaper before disposal.

- Don't leave pet food or other food out during the night.

Water: Cockroaches must have water. To help cut down on your kitchen's cockroach carrying capacity, reduce the number of water sources:

- Repair leaky pipes and faucets. Caulk or putty can be used to seal small leaks around sink fixtures.

- Wipe up any spilled liquids.

- Don't leave pet water out overnight.

Shelter: Cockroaches are thigmotactic or contact-loving, meaning that they like to squeeze tightly into narrow spaces. Their bodies are suitably shaped, being flattened and with a smooth tough outer surface. Though most cockroaches can fly, they are typically runners, and can move swiftly by means of their long powerful legs.

A final important step in making your kitchen or classroom less habitable to cockroaches is to get rid of the kinds of shelter and entryways that cockroaches make use of:

- Caulk or paint over cracks in walls and along baseboards where cockroaches like to hide out. Caulking guns or squeeze caulk work well.

- Remove posters, paper shelf coverings, stacks of boxes or newspaper and other clutter that provide hiding places.

- Remove debris and garbage from near the house or building.

- Block any entryways by weatherstripping crevices where roaches can get in, replacing and repairing screens and broken windows, & screening air vents.

- Inspect grocery bags, boxes and used furniture for roaches or egg cases before bringing them into the house.

You can pinpoint the focus of your cockroach population and monitor populations before and after control efforts with non-toxic traps. These are rectangular cardboard boxes with a sticky material and a cockroach attractant inside. To be effective, these must be placed along wall edges where cockroaches run

For severe infestations, boric acid powder can be dusted into cracks, under stoves, and into wall voids and other inaccessible dry areas. Cockroaches walk through the powder and ingest the boric acid as they clean themselves. Boric acid can be poisonous to people if eaten, but does not vaporize into the air. Use precaution when applying, to avoid inhalation or ingestion. In classrooms, boric acid should be applied only by authorized personnel.

Integrated Pest Management for

FLEAS

The mild San Francisco Bay Area climate is prime flea habitat. If you have a dog or cat, you are sure to have experience with fleas. The flea most commonly found in the home is the cat flea (*Ctenocephalides felis*).

Fleas, like most insects, have four different life stages. Adult fleas commonly feed on the warm blood of dogs, cats and humans. Their eggs are laid on or near the animal, but usually fall off in areas where your pet spends a lot of time (i.e. on the pet bed, in furniture, or in rugs). In a week or two when the larvae hatch, the larvae feed on the dry flecks of blood discarded by adult fleas, and on other bits of organic garbage they find. Larvae, pupae and eggs are most likely to be found in the dusty and hard-to-reach corners of your home or furniture.

The first step in controlling fleas is to control the population on your pet (which is often how fleas get into the house in the first place). It is probably not possible to have a flea-free pet, but these steps should help to keep populations down to a tolerable level:

- Regularly comb your pet with a specially made fine-toothed flea comb. The fleas you catch can be dropped in soapy water where they will drown.

- Bathe your pet regularly as fleas drown easily. Most normal soaps help kill fleas and some (such as Safer Agro-Chem's Flea Soap) are specially formulated to safely rid pets of fleas.

The second step is to keep flea populations from establishing themselves in your home.

- Train your pet to sleep in one area. The bedding can then be cleaned regularly to kill any eggs, pupae or larvae living there.

- Vacuum areas frequented by pets on a weekly basis, especially hard-to-reach dusty corners and under furniture. Immediately dispose of the material collected by burning or by sealing in a plastic bag placed outdoors in the trash.

- If the flea population is large or your rugs very thick, shampooing the rugs should help eliminate many of the fleas there.

- Keep pets out of areas where fleas would be difficult to control (such as bedrooms, attics, basements, rooms with thick rugs).

- If fleas are a problem in the yard, overwatering should help destroy larvae and eggs on the ground.

- Large flea populations may warrant the initial use of relatively safe insecticides. Methoprene is an insect growth regulator which prevents flea eggs and larvae from developing into blood-sucking adults. Pyrethrin-based insecticides can be used to reduce adult populations. Always use precaution when applying pesticides. In classrooms, pesticides should be applied only by authorized personnel.

Integrated Pest Management for

HEAD LICE

Head lice are a common problem in many U.S. schools. Although people often associate head lice with unclean conditions, anyone can acquire head lice, as many school children and parents are finding out.

Head lice (*Pediculus humanus*) are small, grayish-white wingless insects about the size of a tiny ant. Adult lice are usually found on the hairs of the head behind the ears and back of the neck. It is easier to see their eggs (nits) which are small, white, and attached to the hair shaft. Head lice feed on human blood, but in the U.S. head lice rarely carry any serious diseases. They can't jump or fly, but they can easily be transferred from head to head via hats and combs or simply from close contact.

The first step in head lice control is prevention. Cleanliness (such as regular shampooing) will not prevent head lice. The only way to prevent the spread of head lice is to prevent the kind of contact that allows lice to crawl from one head to the next:

- Children should not share hats, combs, brushes, scarves, towels, coats or other personal items, especially when head lice cases are prevalent in a school.

- Schools should provide individual/separate storage for hats and coats.

- School districts should carry out regular head checks (after summer and winter breaks) to catch cases as soon as possible, including immediate head checks of all students in any classroom with an identified case.

Once a child (or anyone) has acquired a case of head lice, the safest method of treatment is to pull the nits out with a specially manufactured fine-toothed comb (Innomed and Derbac are the most effective). These allow hair to pass between the teeth, while catching the nits and lice. The hair should be combed once a day for 12 days, since eggs will continue to hatch out for 8 - 10 days.

If the hair cannot be combed, insecticidal shampoo containing pyrethrins can be used (common brand names include A-200, Rid, Triple-X). Natural pyrethrins are extracted from the pyrethrum plant, but they are still poisons. If pyrethrin shampoo is used, it should be used as infrequently as possible, directions should be followed closely, and the shampoo should be safely stored. Any unnecessary exposure should be avoided. Shampoos containing lindane (Kwell) are not recommended. Lab studies suggest that lindane may cause adverse health problems.

Head lice can live for only three days off the head, and so are not usually a problem in the general environment. If you have had a case in your household, you can help prevent spreading the head lice to other family members by doing thorough cleaning. Application of pesticides in the home is not necessary.

- Thoroughly vacuum furniture, rugs and floors.

- Wash bed linens and clothing in hot water (140° F for 20 minutes. Heat will kill head lice.)

- Heat unwashables in clothes dryer (hot cycle: 150° F for 20 minutes).

- Dry clean or store other articles for 20 days in sealed plastic bags.

Integrated Pest Management for

MOSQUITOS

Mosquitos are a pest problem not only because of their annoying bite, but because they can transmit serious diseases such as malaria and yellow fever. These diseases are not often a problem in the western U.S., but occasional mosquito-borne diseases can break out.

The best way to protect ourselves from mosquito bites is to prevent the build-up of large populations and to wear clothing and use screens which can reduce bites from the mosquitos which do live around us.

Most adult female mosquitos feed on blood from warm-blooded animals (males feed on nectar). The eggs of most species are laid in or around water. After about one week (depending on the temperature), the eggs hatch. All mosquito larvae live in still bodies of water where they float at the surface and dive to the bottom to feed on decaying vegetable matter or water micro-organisms. The larva becomes a floating pupa after 4-10 days, and then takes 2-3 days to change into an adult.

Because mosquitos are so dependent on water, one effective way to control local populations is to eliminate open water outdoors where mosquitos breed and larvae develop. These include: open cans, jars, containers, roof gutters, troughs, wading pools, tire ruts, puddles from leaky faucets or sprinklers, bird baths, wheelbarrows and treeholes. Open tanks can be screened off. Treeholes can be filled in with sand.

Ornamental fish ponds can be stocked with fish that live on mosquito larvae (such as *Gambusia affinis*). These fish are often available from your local mosquito abatement district.

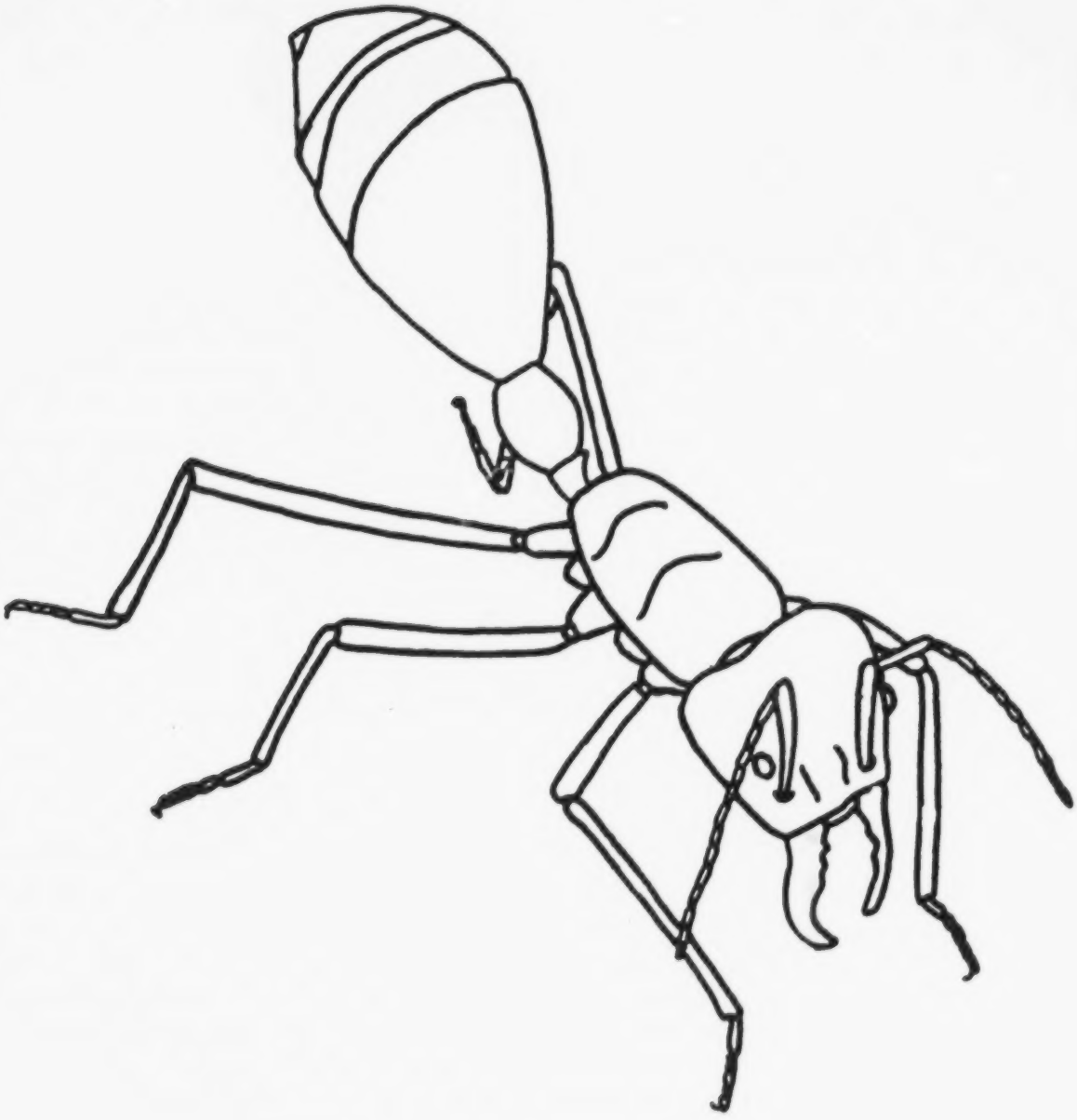
Controlling mosquito populations safely requires an organized community control effort, with help from your mosquito abatement district. A good community control program would include the following steps: 1) Monitoring to determine how serious the problem is and what species you are dealing with; 2) Setting tolerance limits beyond which control measures will be taken (such as frequency of mosquito bites); 3) Locating and eliminating important larval sources by draining, stocking with fish or other natural controls such as the bacteria *Bacillus thuringiensis israelensis* ; and 4) Educating the community about how they can reduce larval sources around their homes.

Individual protection from biting mosquito adults is possible to some degree:

- Screen your windows and doors to keep mosquitos out of your home (16 meshes/inch will exclude mosquitos).

- When outdoors, wear light colored, long-sleeved and long-legged clothes made of tightly woven cotton.

- Use a repellent containing DEET (N,N-diethyl-metatoluamide) applied to clothing around exposed skin (not directly on the skin) including collar, cuffs and hat brims.



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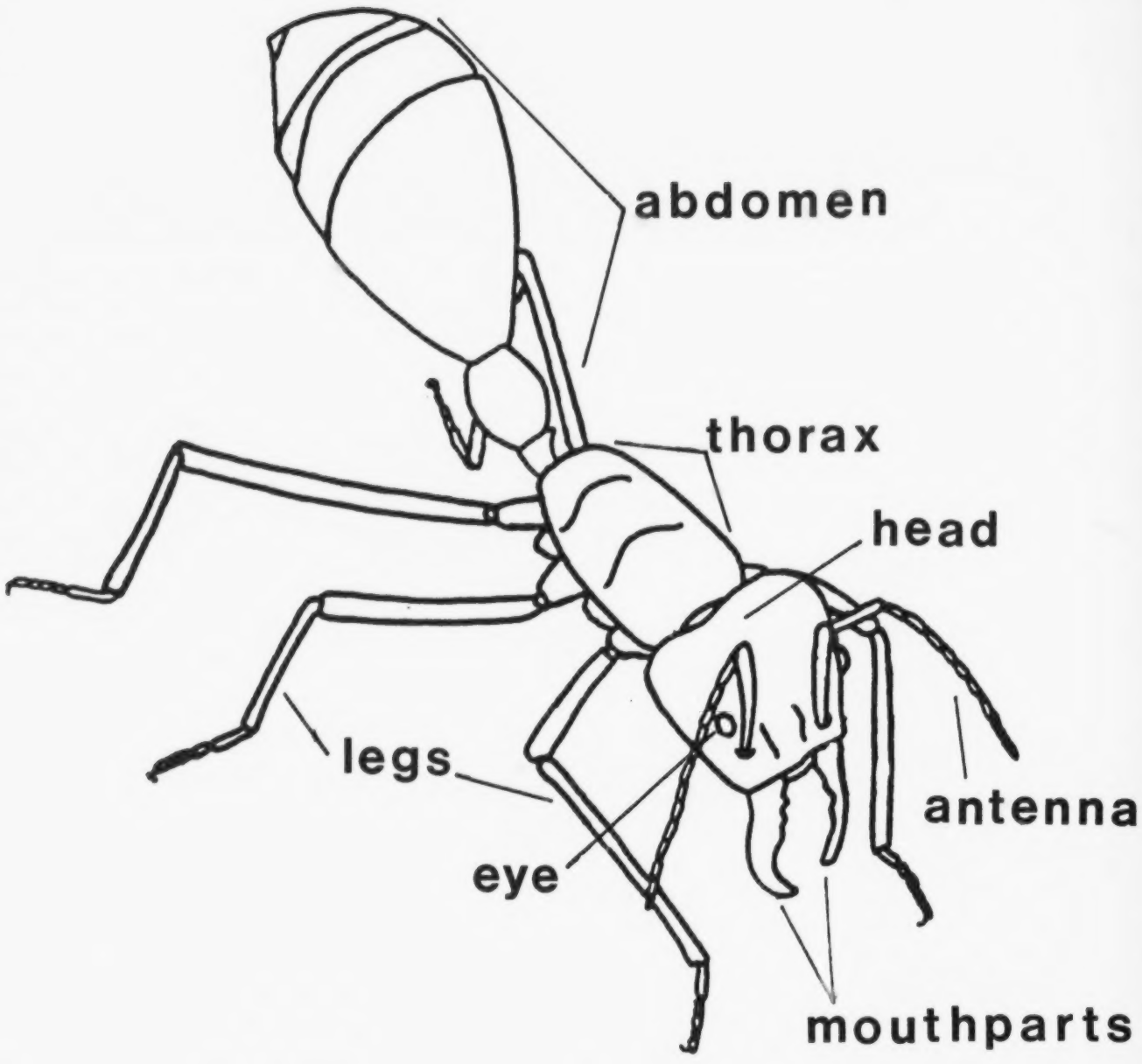

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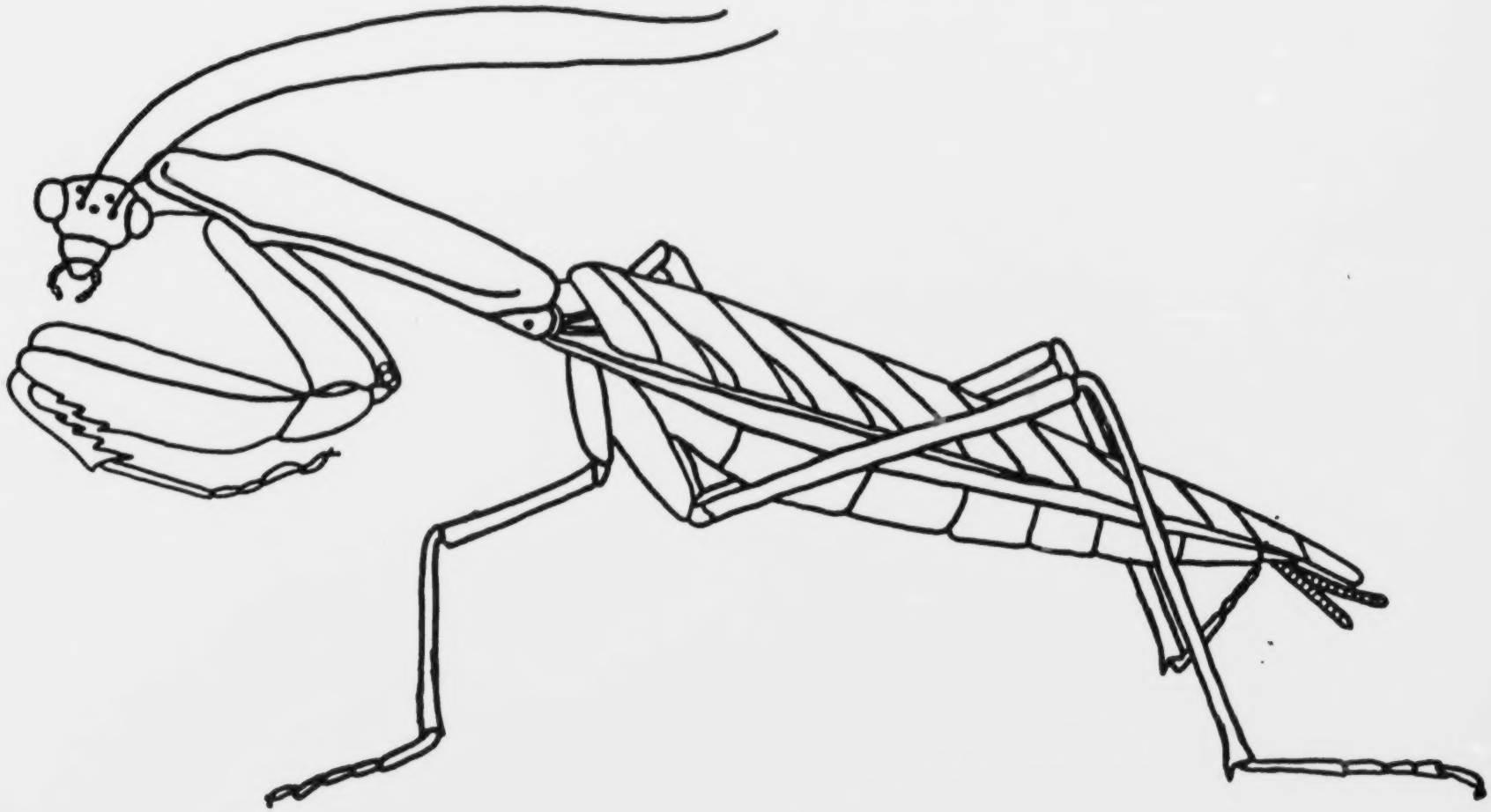

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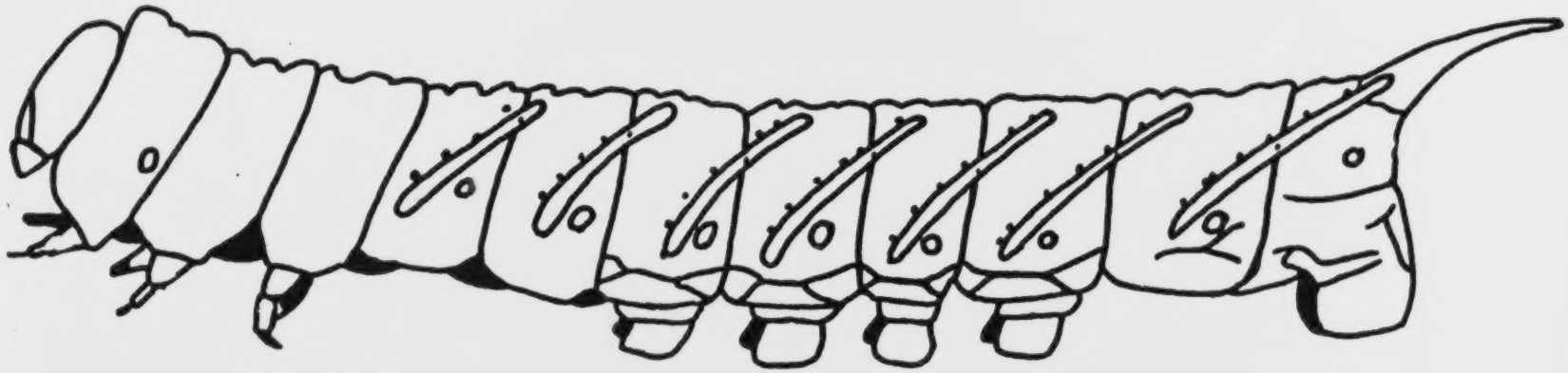
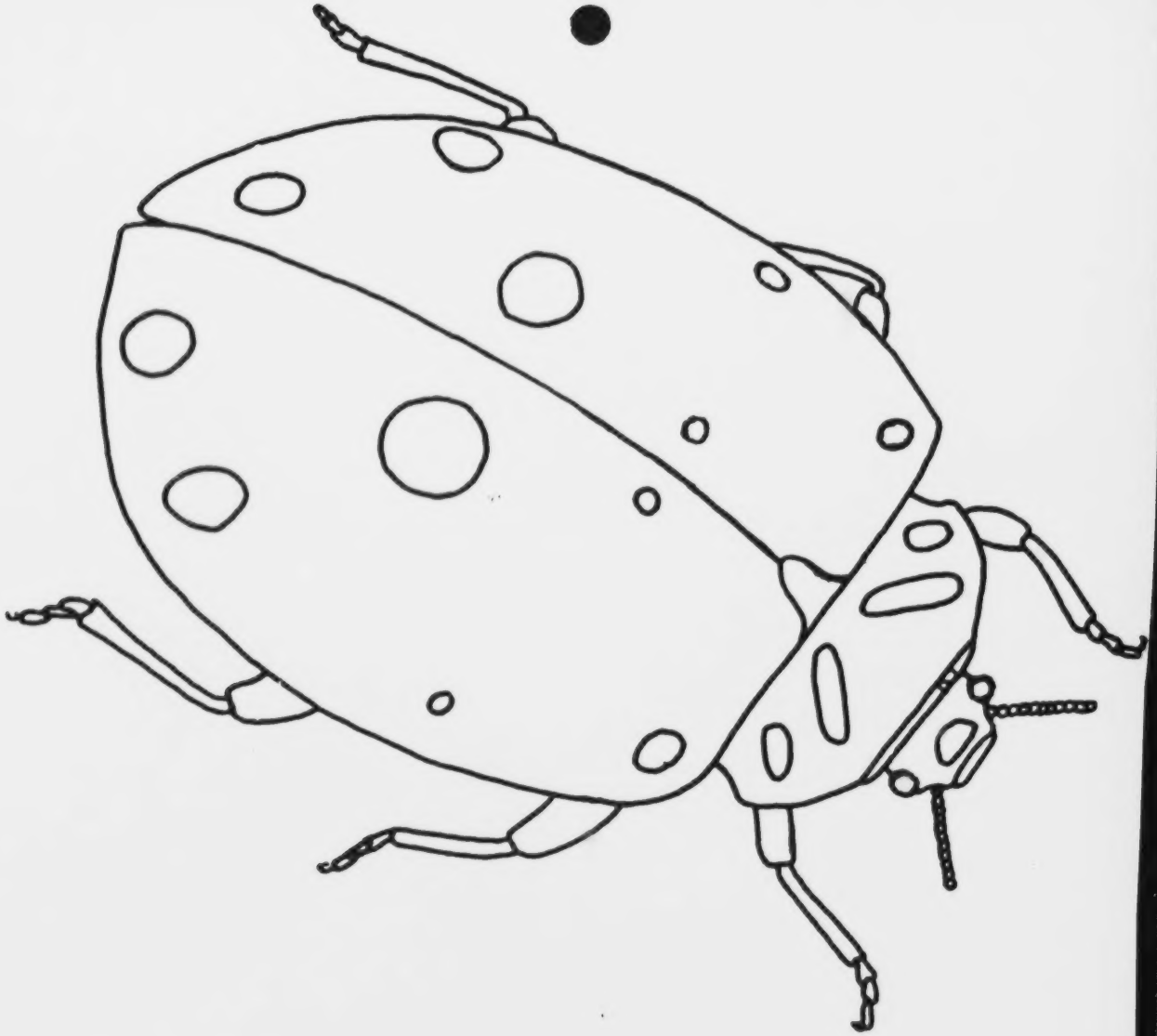
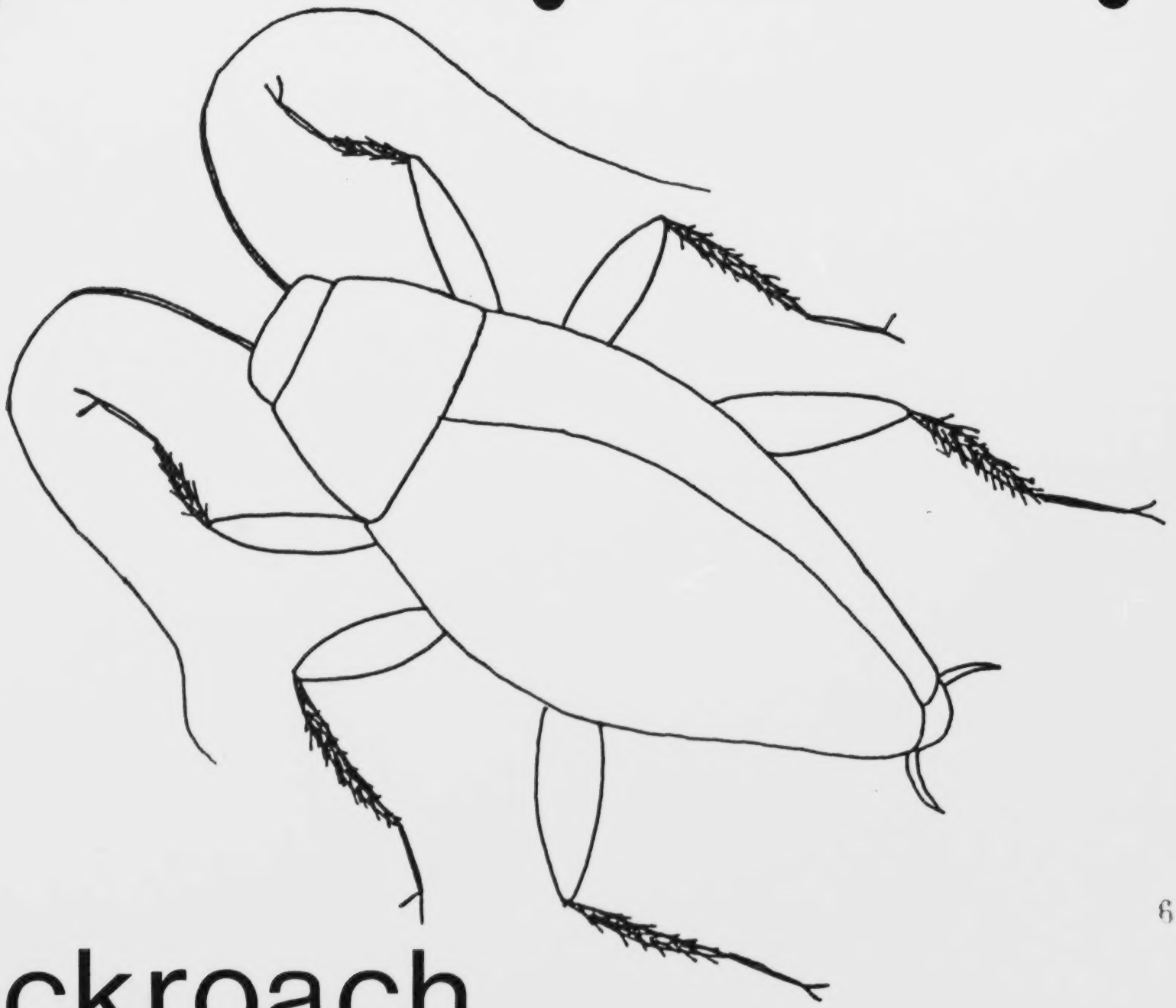


caterpillar



lady beetle



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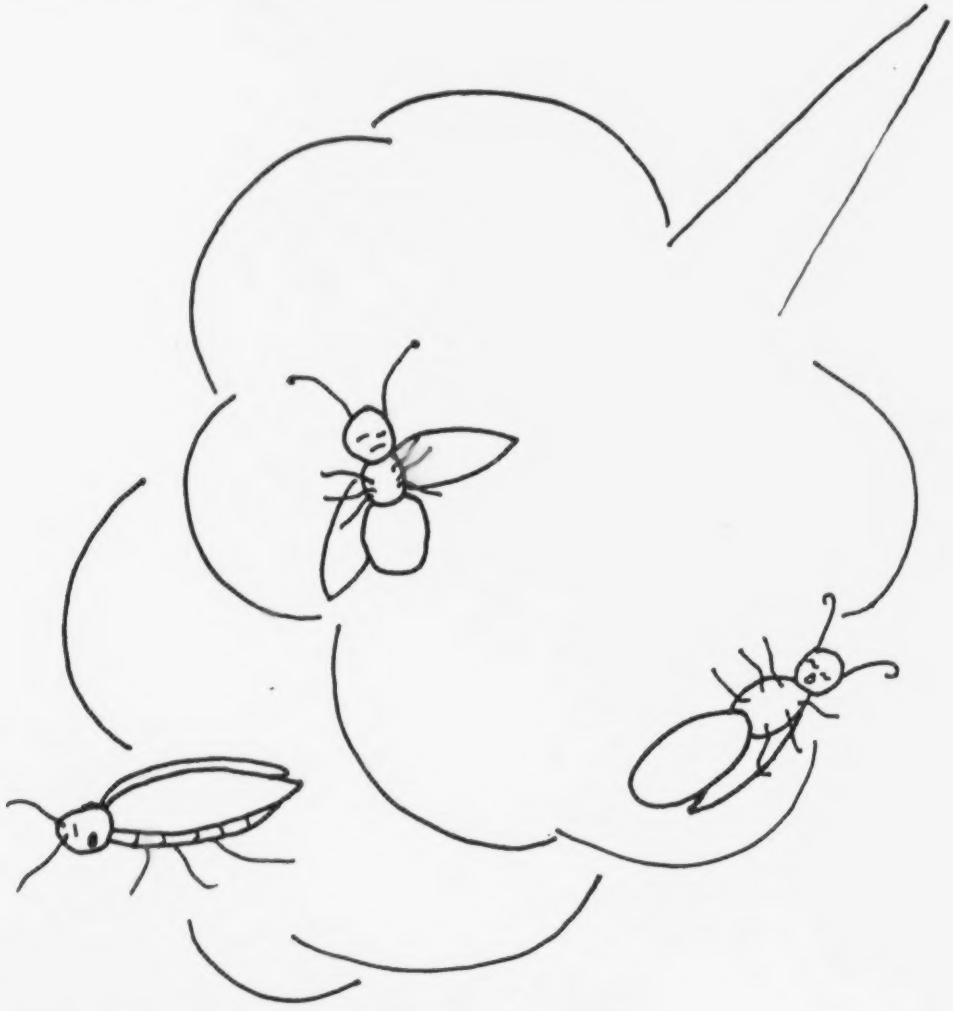
cockroach

INSECTICIDE



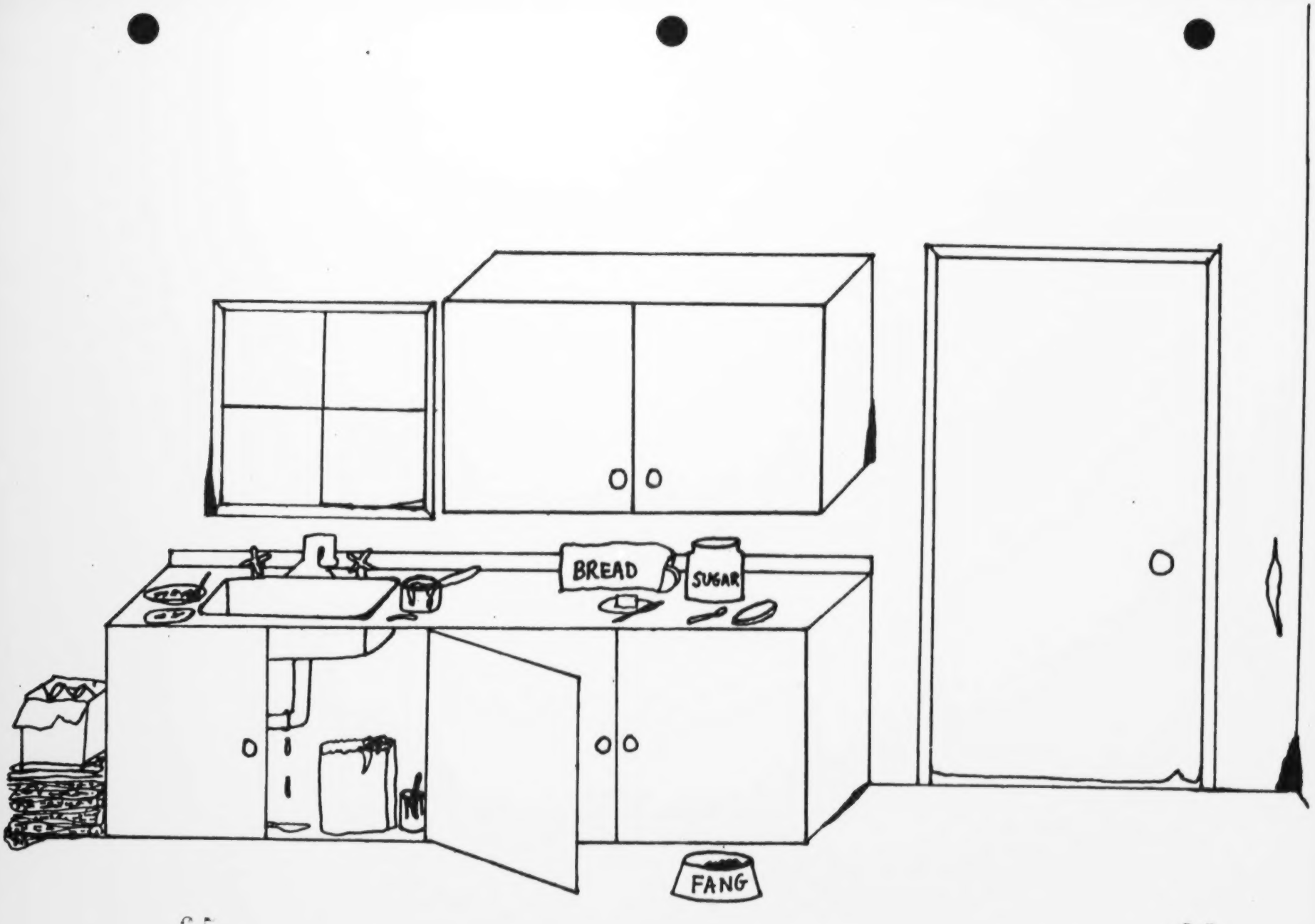
DANGER

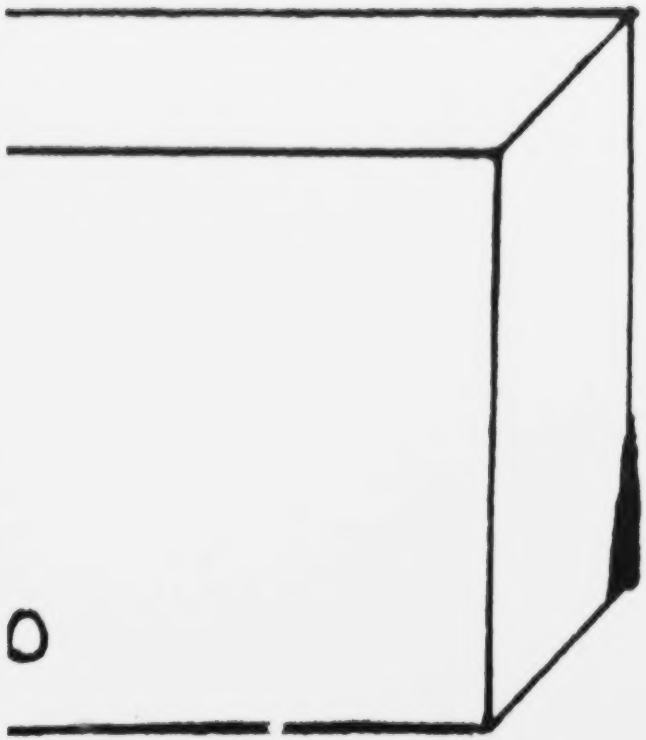
Keep out of reach of children

WARNING

POISON

CAUTION:
keep out of reach
of children


BREAD
SUGAR
FANG



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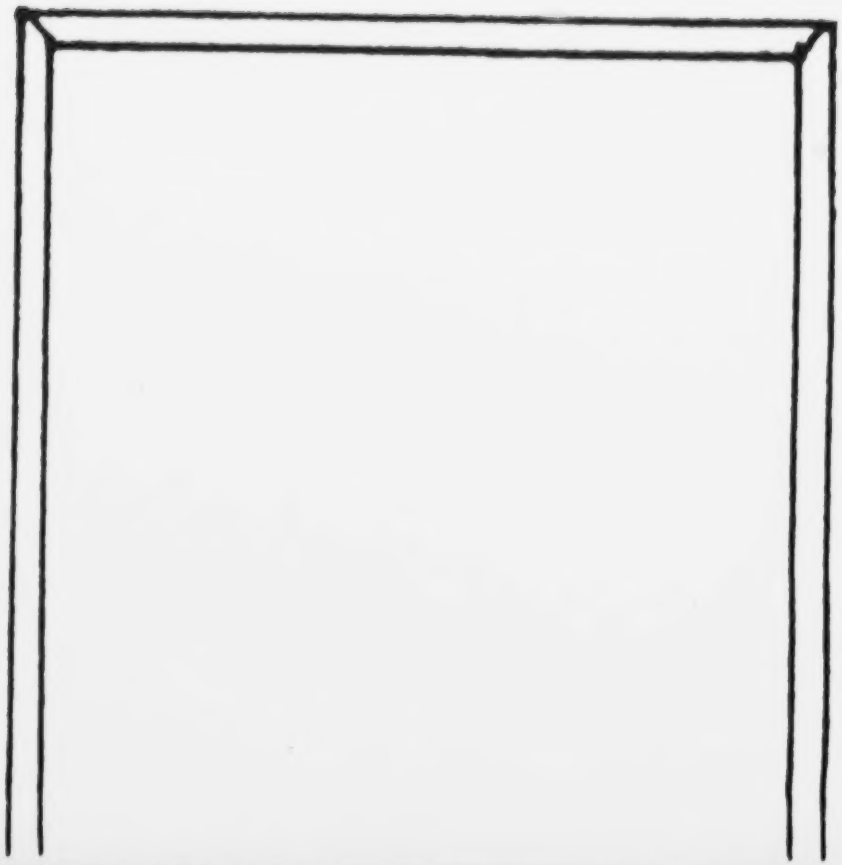

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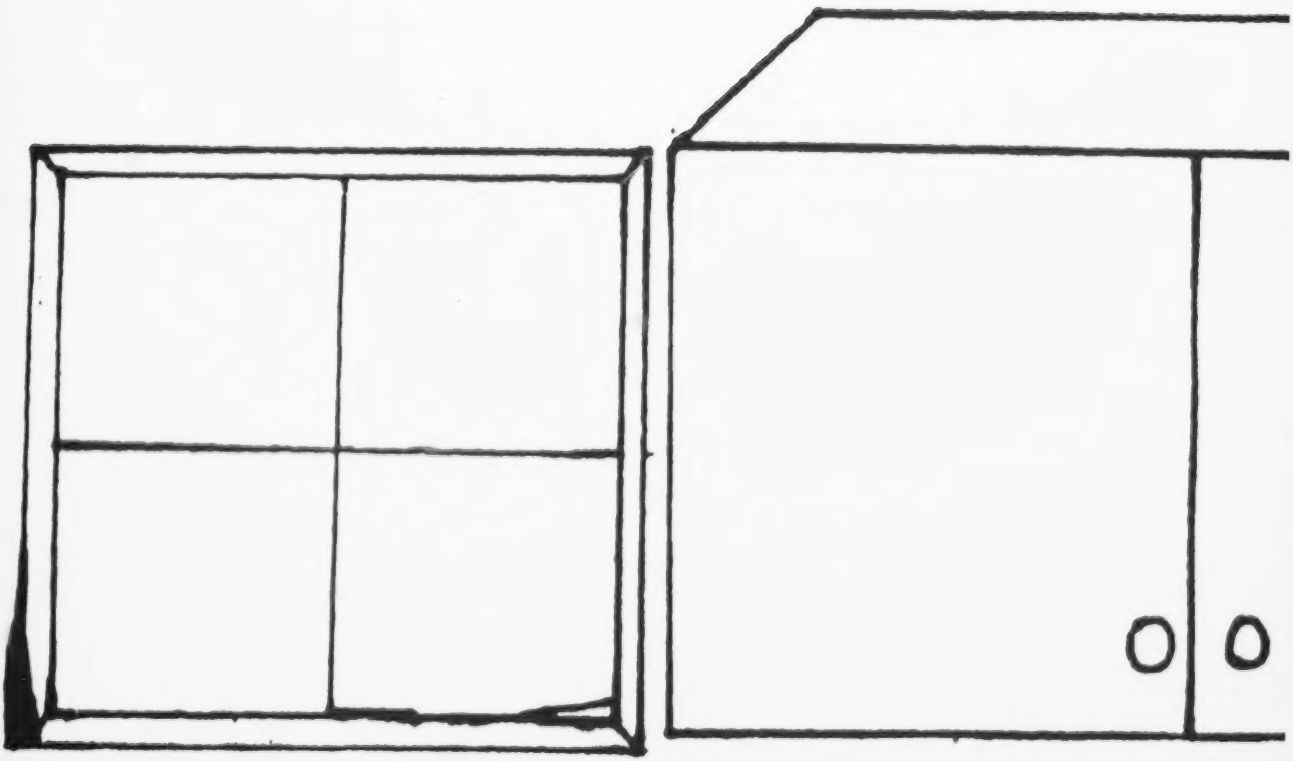

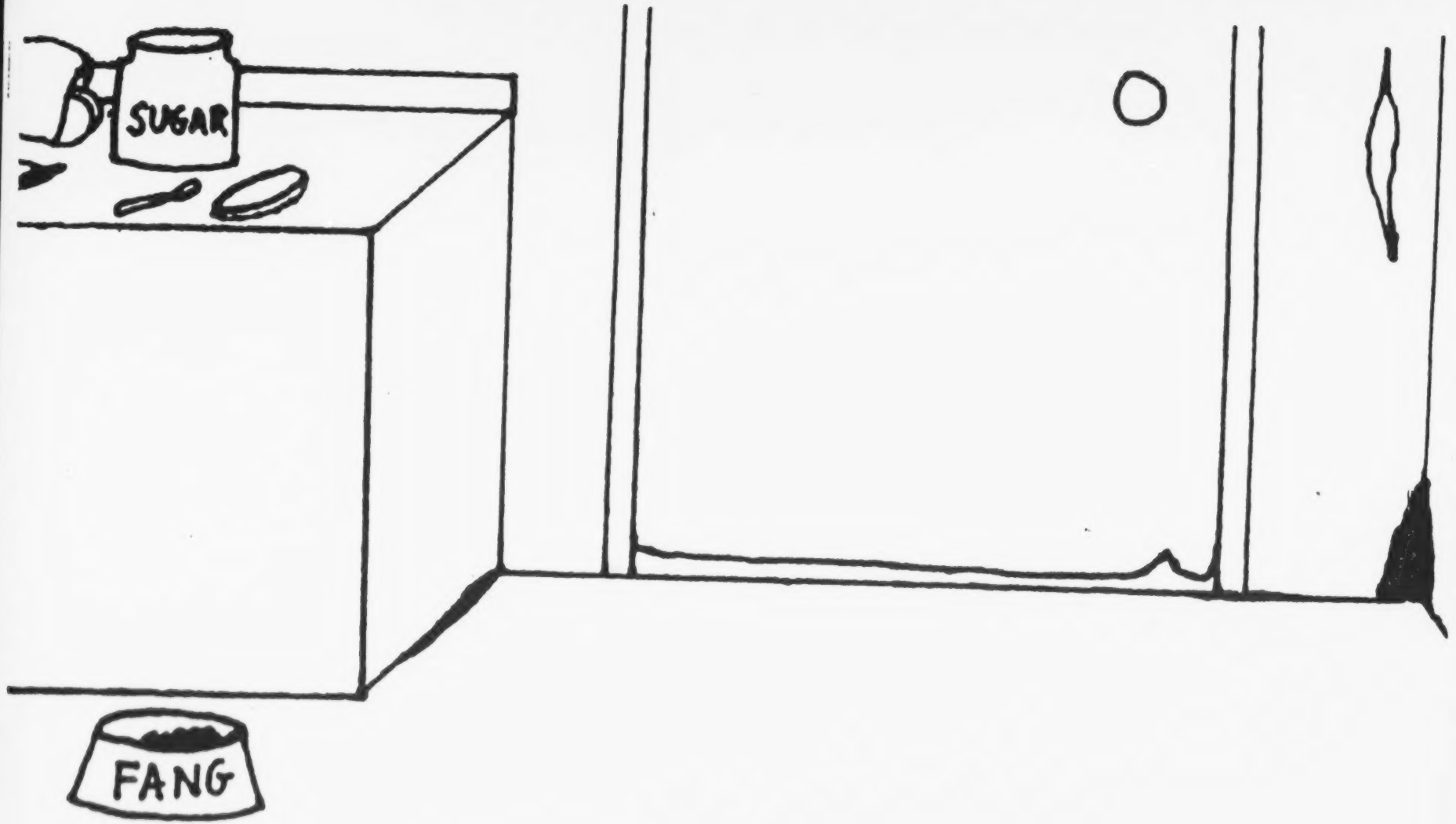
SUGAR
FANG

Dear Parent(s):

In our science unit, we are learning about urban insects and pest management. We are learning how people contribute to some pest problems and how we can help get rid of many pest problems without using pesticides.

This week we are learning about pesticides and other products used in and around the home that are potentially dangerous.

Each year, thousands of young children are accidentally poisoned. Many suffer serious injuries and some die from swallowing medicines, polishes, insecticides, drain cleanser, etc. It is our responsibility to make sure that children, as well as pets, are not exposed to potentially hazardous substances.

Authorities suggest that the average home contains over 45 products containing potentially hazardous substances. Such products can be found in the kitchen, bathroom, laundry room, garage--virtually every room in the house.

The following list is provided to assist you in "poison proofing" your home.

To poison proof your home, these products should be placed in areas not accessible to children--for example, a high cupboard or locked cabinet. In addition, the products should always be kept in their original containers. When possible, products with safety caps should always be bought.

If possible, poison proof at least one room in your child's presence and explain how the products might hurt children if played with or eaten. This would reinforce what they are learning in school.

Although the list is not complete, it will provide you with an idea of what should be considered dangerous to young children.

Thank you very much.

POISON PROOFING YOUR HOME--WHAT TO LOOK FOR

KITCHEN

Cleanser, Bleaches
Furniture Polish
Air Fresheners
Floor Wax
Drain Opener
Oven Cleaner
Aerosol Products
Shoe Polish
Pesticides

GARAGE/LAUNDRY ROOM

Lighter Fluid
Pool Chemicals
Detergents, Fabric Softeners
Kerosene, Gasoline, Antifreeze
Furniture Strippers
Paints and Thinners
Motor Oil
Hobby Supplies

BATHROOM

Bubble Bath
Medicines
Toilet Bowl Cleaners
Disinfectants
Personal Hygiene Products

BEDROOM

Cosmetics
Moth Balls
Perfumes/Powder
Sachets
Nail Polish/Remover

(This letter has been adapted with permission from "Toxics in Home? You Bet!", a curriculum on household toxics by the Golden Empire Health Planning Center.)

Evaluation of Urban Insect Ecology and Pest Management Curriculum

Name (optional): _____

Grade Level: _____

School: _____

Please take a few moments to help us improve this program by filling out this evaluation form. You can fold and mail it to Citizens for a Better Environment (CBE) at 942 Market Street, Suite 505, San Francisco, CA.

Classroom Presentation	poor	satisfactory	excellent
1. Information was well-suited to age level.	_____	_____	_____
2. Activities were well-suited to age level.	_____	_____	_____
3. Activities provided effective hands-on experience.	_____	_____	_____
4. Appropriate balance between information presentation and activities.	_____	_____	_____

Please comment on the strengths and weaknesses of particular activities. (Did any stand out as being especially effective? Why? Should any activities be dropped from the program? Why?)_____

_____

_____

Written materials

Was there enough background information so that you felt well enough informed to present each unit on your own?_____

What additional information is essential?_____

_____

What information did you find to be particularly useful?_____

_____

Were the unit format and activity instructions clear and usable? Please comment on how they could be improved._____

_____

Additional comments:_____

_____

_____

Thank you for your help.

SLIDE SHOW ORDER FORM

The slide show contains 22 slides of common household and garden insects and is accompanied by a written text that can be "read" with the slides. Please allow two weeks for delivery . All orders must be accompanied by a check for $4.50/slide show, made out to Citizens for a Better Environment (CBE), and a $15 deposit to be returned when slides are returned to CBE. Please return slide set within three weeks of receipt. A late fee will be deducted from the deposit.

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